T.O. 31R4-2CRD6-2
(Formerly AN16-30CRD6-3)

HANDBOOK

MAINTENANCE INSTRUCTIONS

RADIO DIRECTION FINDER
AN/CRD-6

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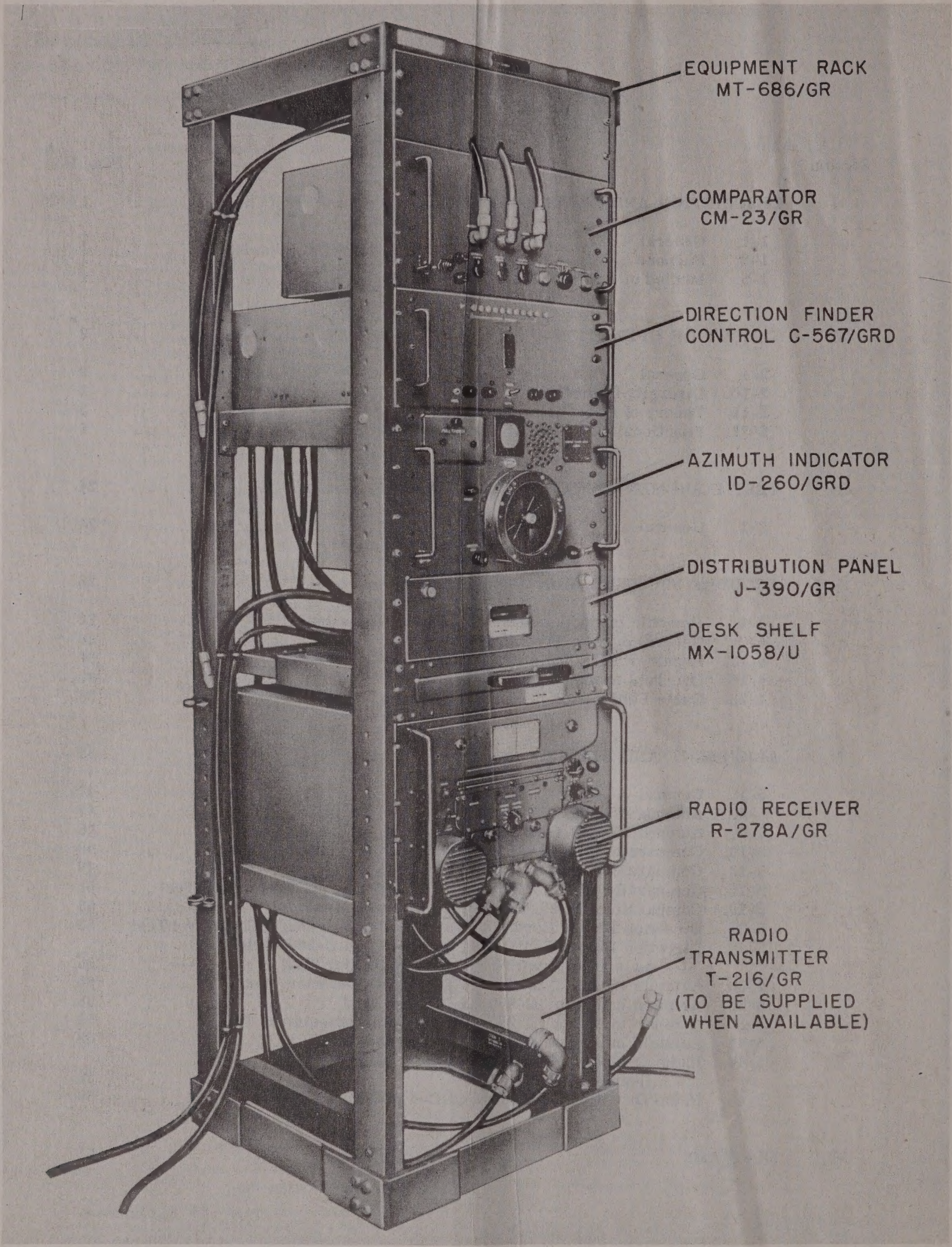
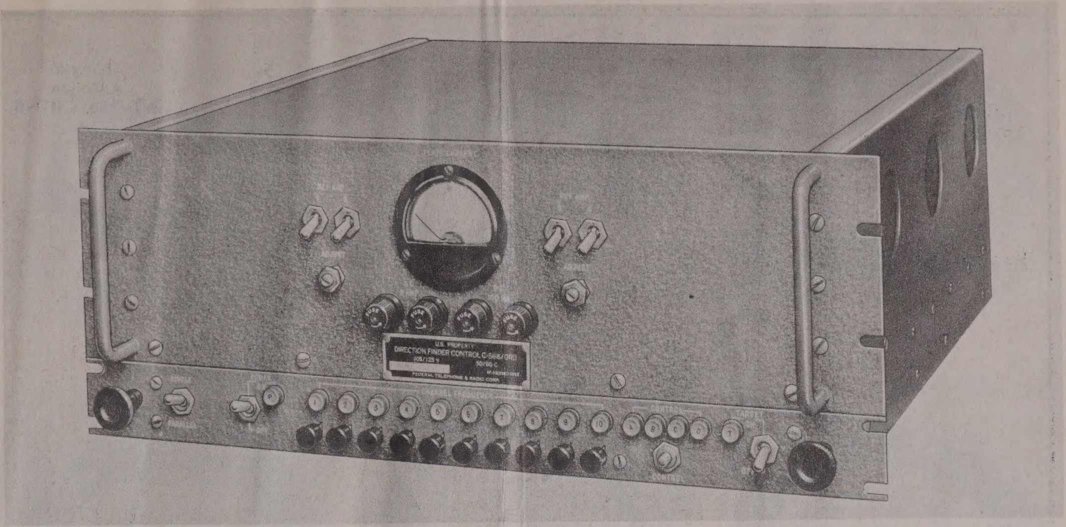
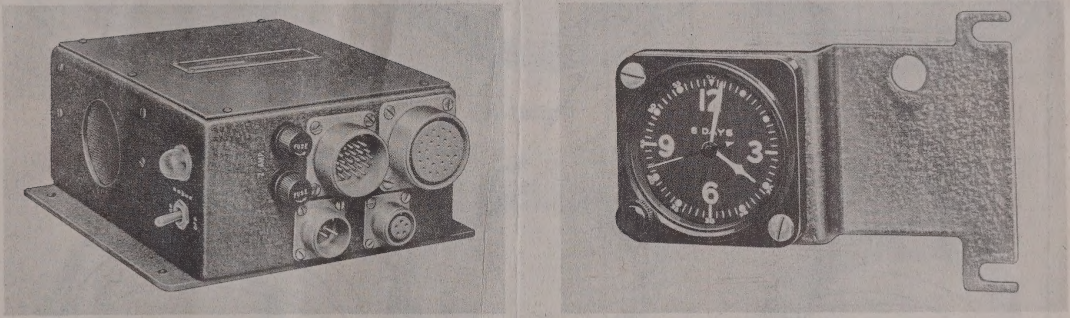

EQUIPMENT RACK MT-686/GR
COMPARATOR CM-23/GR
DIRECTION FINDER CONTROL C-567/GRD
AZIMUTH INDICATOR ID-260/GRD
DISTRIBUTION PANEL J-390/GR
DESK SHELF MX-1058/U
RADIO RECEIVER R-278A/GR
RADIO TRANSMITTER T-216/GR (TO BE SUPPLIED WHEN AVAILABLE)

Figure 1-1 (1 of 6). Radio Direction Finder AN/CRD-6

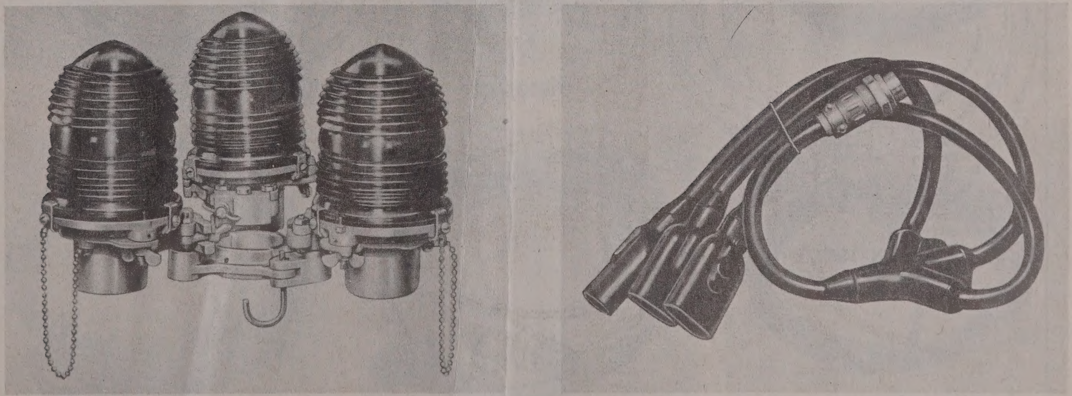

U.S. PROPERTY
DIRECTION FINDER CONTROL C-568/GRD
FEDERAL TELEPHONE & RADIO CORP.

Direction Finder Control C-568/GRD



Junction Box J-476/CRD-6

Clock, 8-Day Wind



Hazard Lights and Bracket Assembly

Hazard Lights Cord Assembly W-701

Figure 1-1 (2 of 6). Radio Direction Finder AN/CRD-6

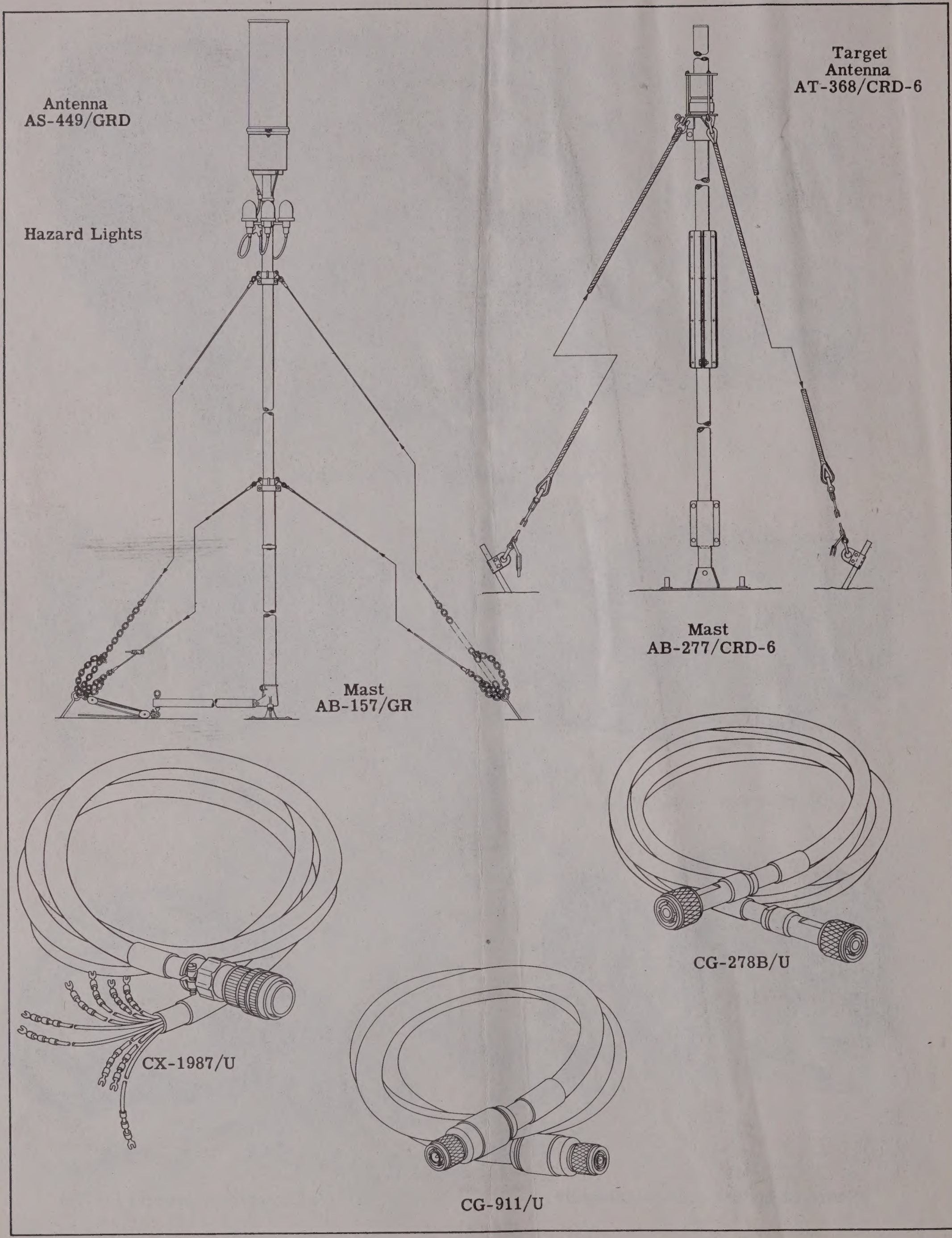
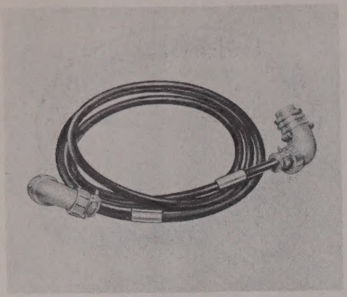


Figure 1-1 (3 of 6). Radio Direction Finder AN/CRD-6



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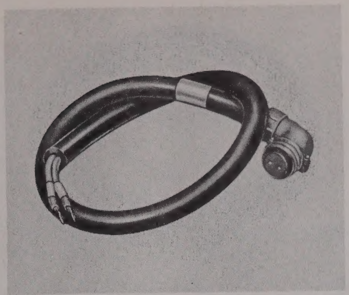

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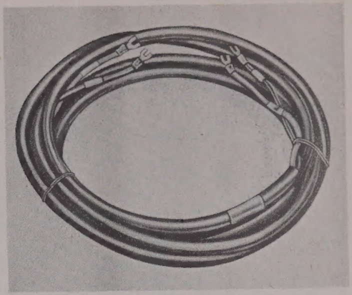

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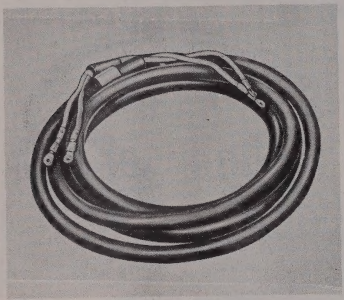

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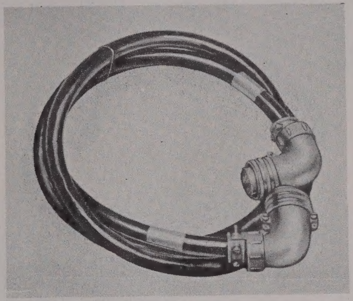

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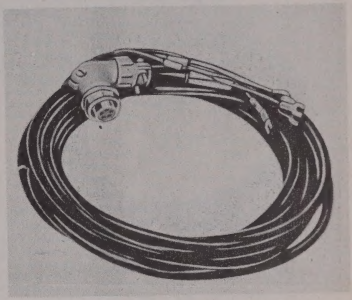

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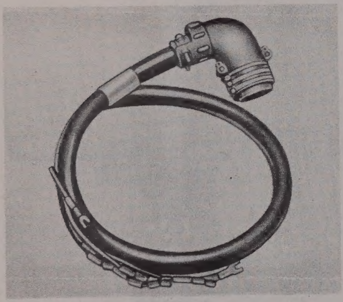

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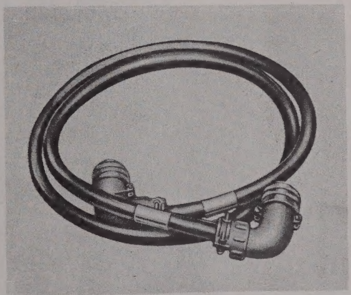

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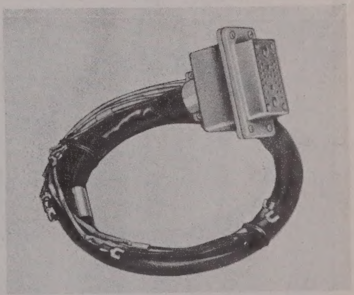

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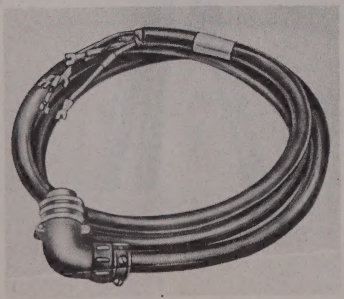

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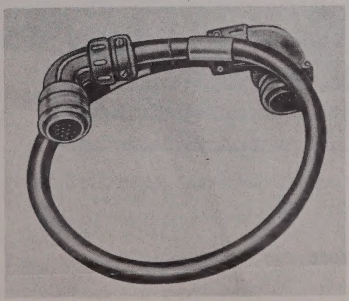

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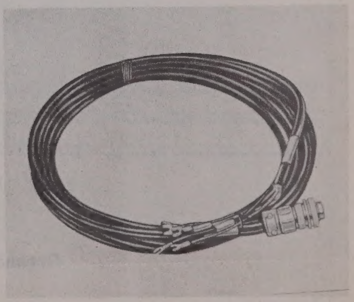
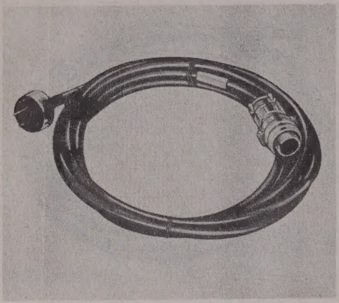


CX-2006/U

Figure 1-1 (4 of 6). Radio Direction Finder AN/CRD-6



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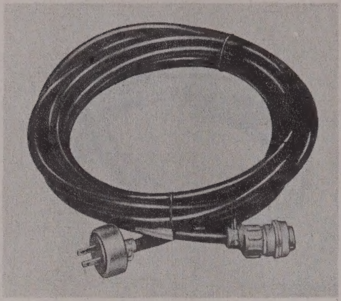

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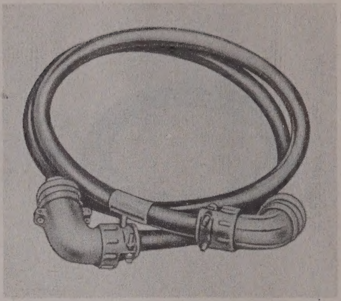

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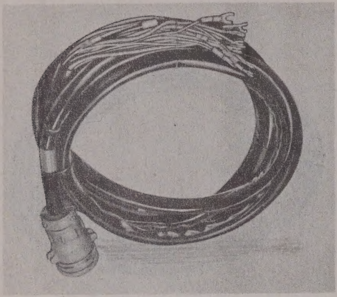

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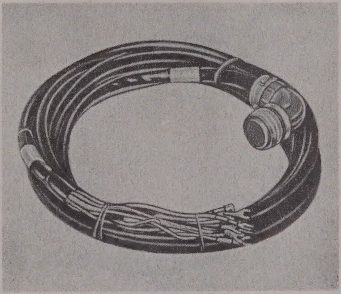

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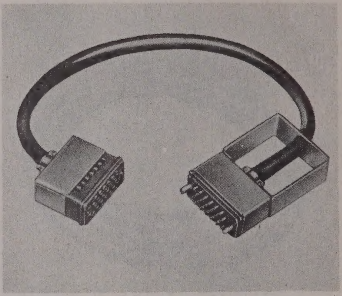

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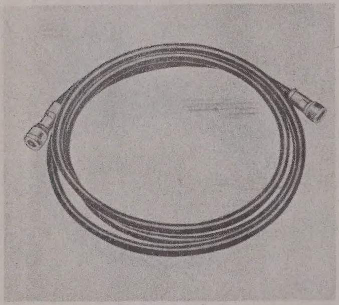

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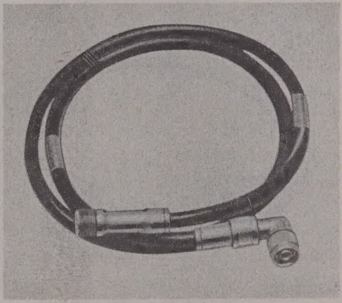

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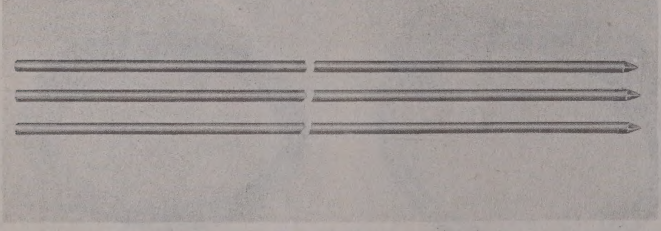
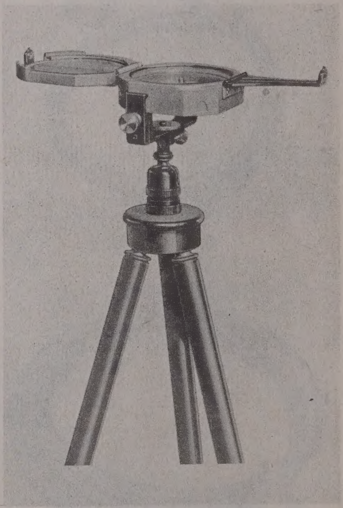


Ground Rods



Transit MX-409/U

Figure 1-1 (5 of 6). Radio Direction Finder AN/CRD-6

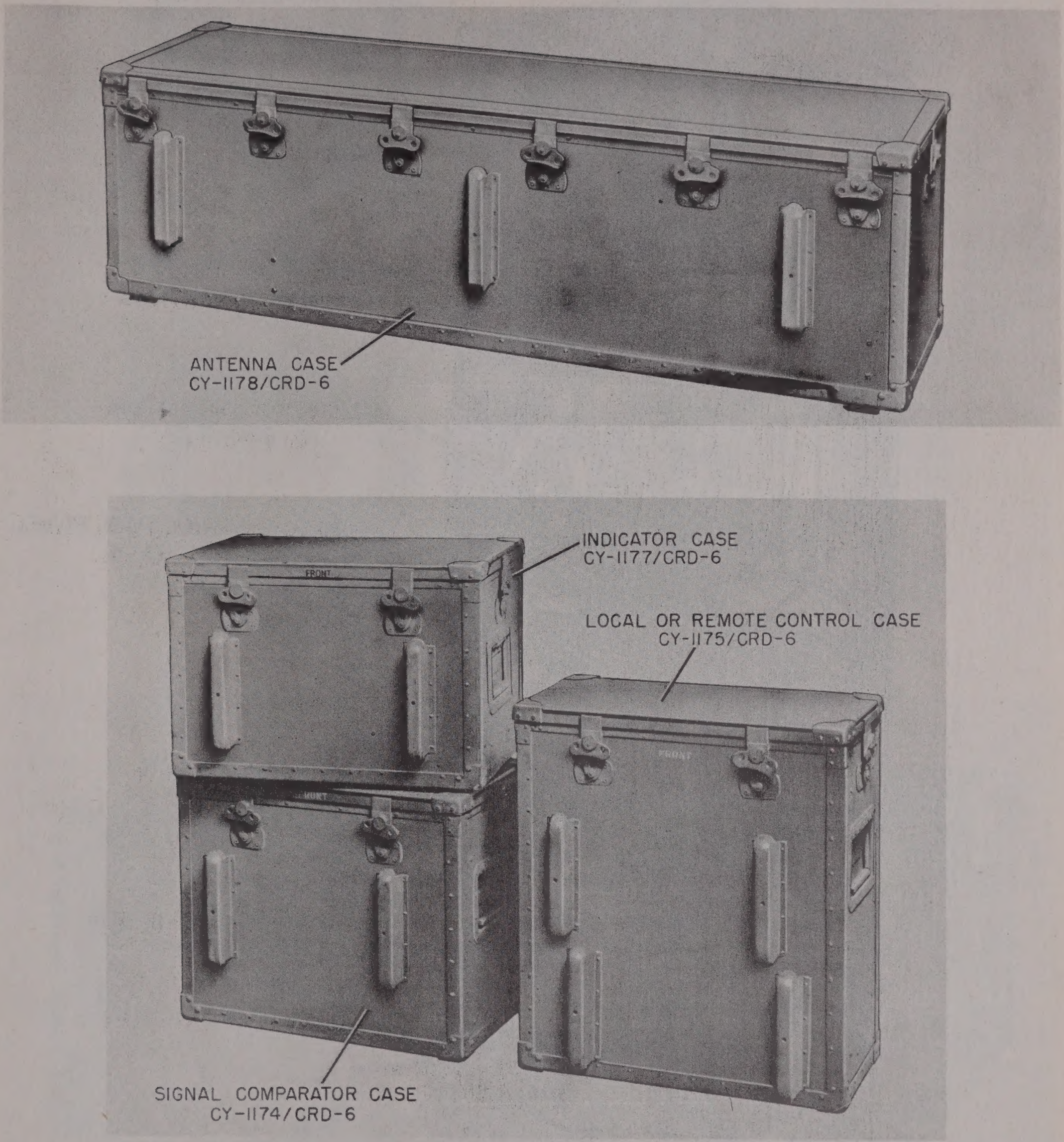


Figure 1-1 (6 of 6). Radio Direction Finder AN/CRD-6

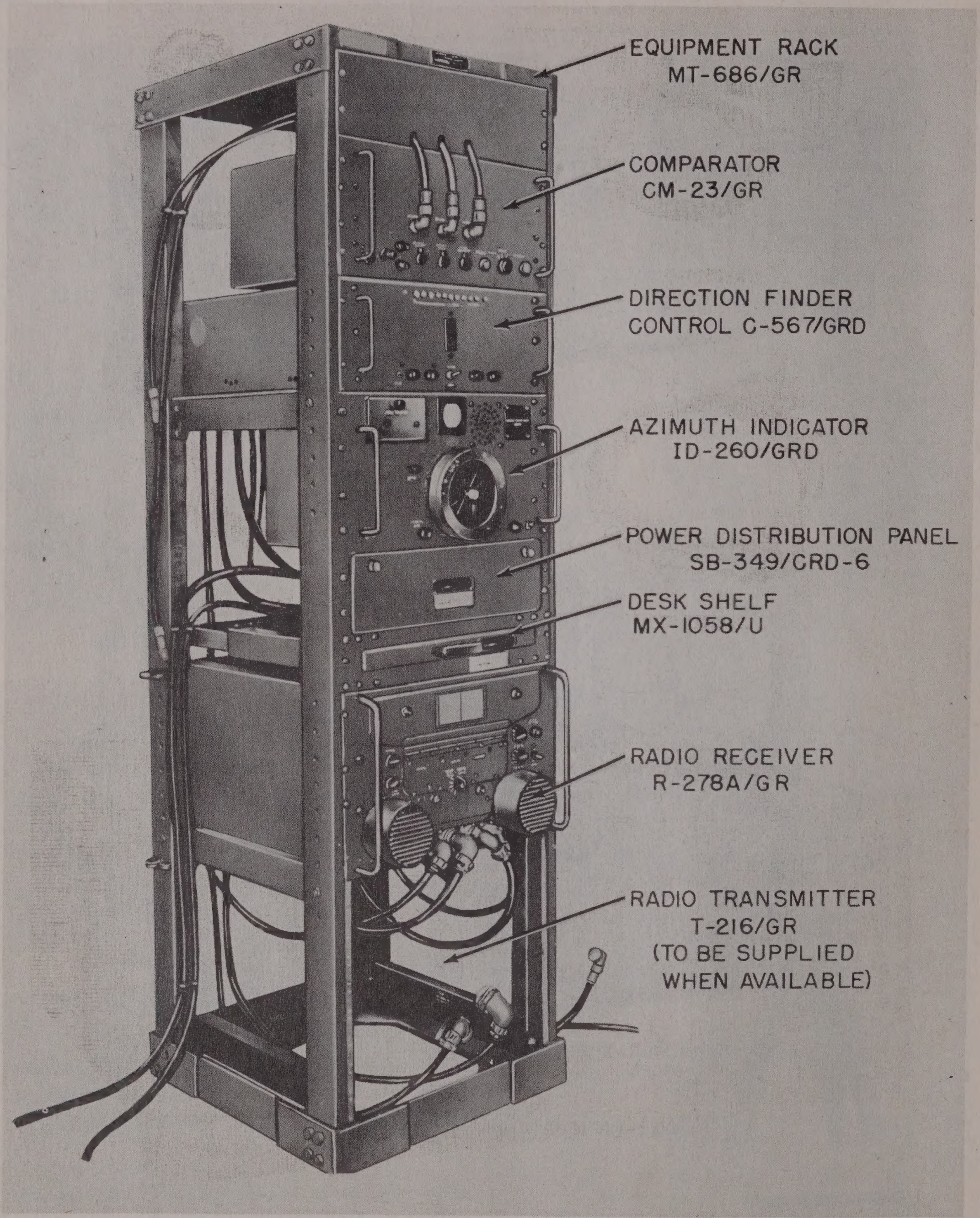
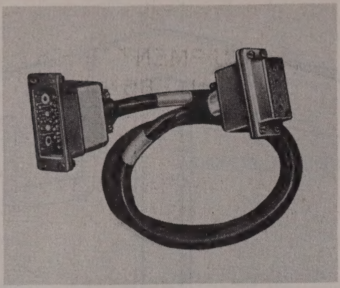

EQUIPMENT RACK MT-686/GR
COMPARATOR CM-23/GR
DIRECTION FINDER CONTROL C-567/GRD
AZIMUTH INDICATOR ID-260/GRD
POWER DISTRIBUTION PANEL SB-349/CRD-6
DESK SHELF MX-1058/U
RADIO RECEIVER R-278A/GR
RADIO TRANSMITTER T-216/GR (TO BE SUPPLIED WHEN AVAILABLE)

Figure 1-1A. (1 of 3) Radio Direction Finder AN/CRD-6, as manufactured under Air Force Contract No. AF33(038)-30605



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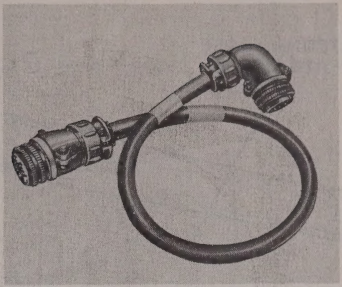

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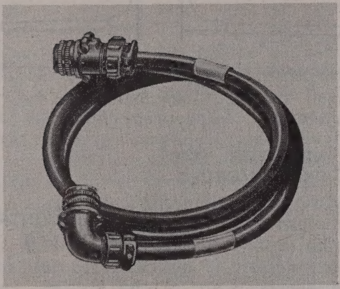

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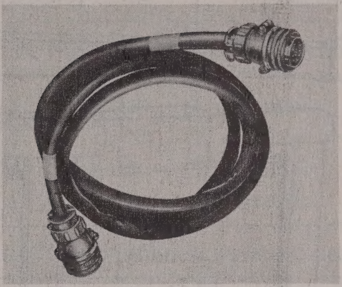

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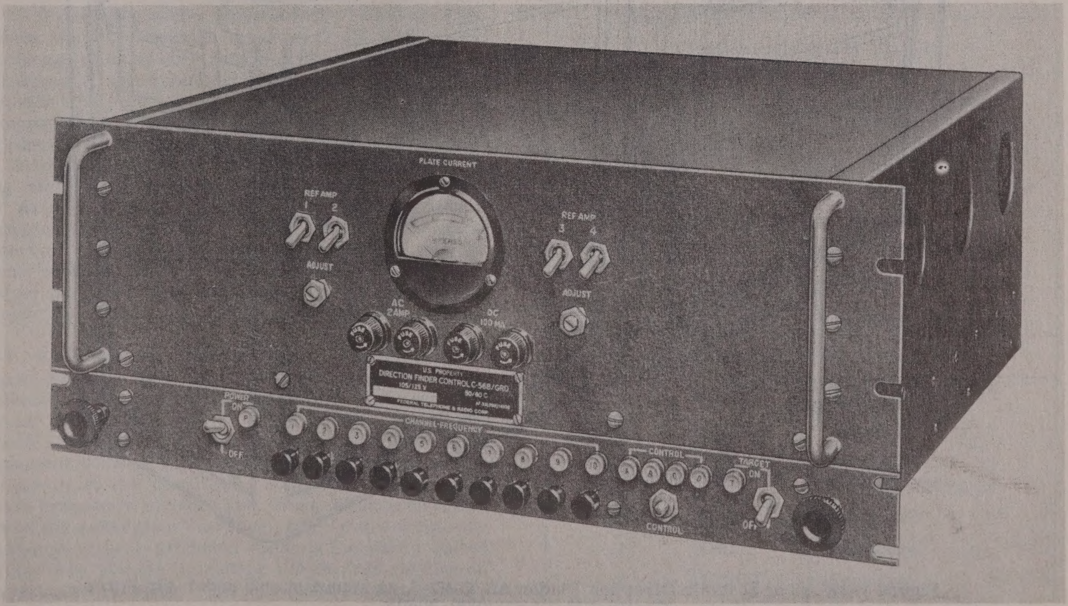


Figure 1-1A. (2 of 3) Direction Finder Control C-568/GRD, as manufactured Under Air Force Contract No. AF33(038)-30605

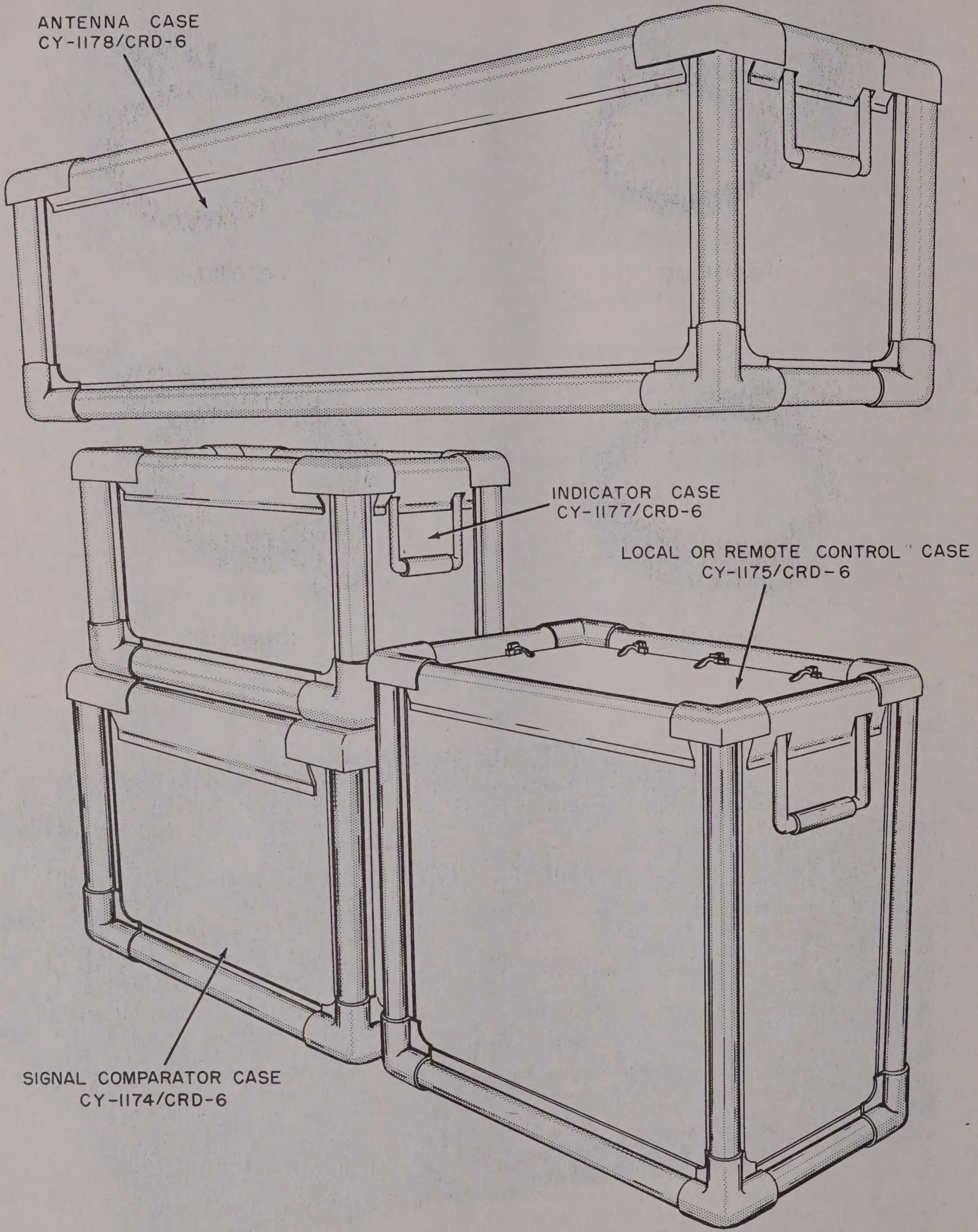


Figure 1-1A. (3 of 3) Radio Direction Finder AN/CRD-6, as manufactured under Air Force Contract No. AF33(038)-30605

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL.

1-2. This handbook contains maintenance instructions for Radio Direction Finder AN/CRD-6, as manufactured by Federal Telephone and Radio Corp, Clifton, N.J. and Raytheon Mfg Co, Chicago, Ill. (See page A)

1-3. PURPOSE.

1-4. Radio Direction Finder AN/CRD-6 is used as a homing device at air bases or for general radio direction finding. This equipment operates over the frequency range of 225 to 400 megacycles. It is designed to minimize bearing errors caused by signal variations resulting from interference at the antennas between ground-reflected and direct waves. Continuous bearing information is automatically indicated at either a local station or at any or all of as many as four remote stations simultaneously. The system may be controlled from the local station or from any of the remote stations. All AN/CRD-6 components are air transportable.

1-5. METHOD OF ACCOMPLISHING MISSION.

1-6. Two antennas are independently mounted at different heights to provide space diversity with respect to the signal being received. Because of their different positions in space, both antennas will not ordinarily provide the same signal strength to the receiver. Comparator CM-23/GR determines which antenna is producing the stronger signal and switches the circuits in the equipment so that this signal provides the bearing information indicated in the phasemeter mounted in Azimuth Indicator ID-260/GRD. The comparator samples the output of the other antenna at regular intervals and switches the operation so that this antenna provides the bearing information whenever its output becomes larger than that of the antenna momentarily being used to supply bearing information.

1-7. Each antenna consists of a vertically mounted dipole having a reflector that rotates about it. As the reflector rotates, it amplitude-modulates the received signal at the frequency of this rotation. The motor which drives the reflector also drives a two-phase generator whose output frequency is the same as the frequency of the modulation applied to the received radio-frequency signal. The phase displacement between the modulation envelope of the radio-frequency and the generator-produced voltages (hereafter called "reference voltage") produce the desired reading on the azimuth indicator. The comparator switches the reference voltages in synchronism with the switching of the Antenna AS-449/GRD r-f output so that the DF information from either antenna is always compared with the reference voltages from its own generator.

TABLE 1-1

TUBE COMPLEMENT BY COMPONENT

Quantity per Component	JAN Type No.	Function
DIRECTION FINDER CONTROL C-567/GRD		
2	12AX7	Amplifier
1	12AT7	Amplifier
2	6AK6	Amplifier
1	5Y3GT	Rectifier
DIRECTION FINDER CONTROL C-568/GRD		
3	12AX7	Amplifier
6	6AK6	Amplifier
1	5Y3GT	Rectifier
COMPARATOR CM-23/GR		
5	6SN7WGT	Cathode Follower Amplifier and Diode Rectifier Multivibrator Antenna Relay Driver
1	6BA6	Amplifier
1	6AU6	Comparison Tube
1	5Y3GT	Rectifier
2	OB2	Voltage Regulator
AZIMUTH INDICATOR ID-260/GRD		
2	6AU6	Amplifier
1	6AL5W	Clipper
2	12AU7	Amplifier Cathode Follower
2	6AQ5	Amplifier
1	OA2	Regulator
2	5Y3GT	Rectifier
1	2BP1	Cathode Ray Tube
1	12AX7	Amplifier
1	2D21	Sweep Generator

TABLE 1-2

FUSE COMPLEMENT BY COMPONENT

Quantity per Component	Type Number	AMPERE Rating
DIRECTION FINDER CONTROL C-567/GRD		
2	4AG 250-volt slo-blo	0.3 amp
2	4AG 250-volt slo-blo	2 amp
DIRECTION FINDER CONTROL C-568/GRD		
2	4AG 250-volt slo-blo	0.1 amp
2	4AB 115-volt	5 amp
JUNCTION BOX J-467/CRD-6		
2	4AG 250-volt slo-blo	1 amp
COMPARATOR CM-23/GR		
2	4AB slo-blo	5 amp
AZIMUTH INDICATOR ID-260/GRD		
2	4AG	2 amp

TABLE 1-3

ELECTRICAL CHARACTERISTICS

Frequency Range	225-400 mc
Number of Pre-set Channels	10
Signal Reception	cw, mcw
Bearing Indication	instantaneous, automatic
Bearing Accuracy	±3 degrees
DF Sensitivity for ±3-degree Bearing Swing	25 uv per m
DF Sensitivity for ±10-degree Bearing Swing	10 uv per m
Power Source	115 V, 60 or 50 cps ±5%
Sampling Time	0.3 sec
Operating Period	2 to 6 sec (adjustable)

TABLE 1-4

CURRENT REQUIRED AT 115 VOLTS, 50 OR 60 CYCLES PER SECOND

Component	Filament Current 5 V	Filament Current 6.3 V	Standby Current	Normal Operating Current
Azimuth Indicator ID-260/GRD	4 amp	6.6 amp		1 amp
Antenna AS-449/GRD				1 amp
Direction Finder Control C-567/GRD	4 amp			0.7 amp
Direction Finder Control C-568/GRD	4 amp			0.8 amp
Comparator CM-23/GR	2 amp	3.6 amp		1 amp
Junction Box J-476/CRD-6				0.25 amp

SECTION II

THEORY OF OPERATION

2-1. GENERAL.

2-2. This section contains a detailed theory of operation of Radio Direction Finder AN/CRD-6. The operation of the separate components and of the system is described. Circuits and operation are illustrated in the accompanying diagrams.

2-3. Two Antennas AS-449/GRD are used to provide diversity operation so that errors due to ground-reflected waves are eliminated.

2-4. Radio Receiver R-278A/GR receives and detects the outputs of the antennas. Only one antenna provides information to the receiver at a time. Detailed information on the receiver will be found in the applicable handbook.

2-5. Comparator CM-23/GR compares the signals received by each antenna and determines which antenna shall be used to provide the bearing information. The comparator, however, continues to sample the output of the other antenna and will switch the operation whenever it provides the stronger signal.

2-6. Direction Finder Control C-567/GRD turns on the power to all the components mounted at the local position. When switched to remote operation it amplifies the reference voltage and the DF signal before sending them out to the remote stations. It also contains all the control and switching relays which control the operation of the system when operating from a remote station.

2-7. Junction Box J-476/CRD-6 contains a power supply and stepping relay which together energize an indicator light on each Direction Finder Control C-568/GRD showing and determining which remote control station has control of the system. The junction box also provides the connections between the spiral-four cable from the local position and the remote stations, and operates relay K-401 in control C-568/GRD to complete the phantom circuit.

NOTE

Junction Box J-476/CRD-6 is used only when two or more remote stations are installed.

2-8. Direction Finder Control C-568/GRD can, at will, assume control of the whole system and thereafter perform all the functions necessary for proper operation. In addition, since only one phase of the reference voltage is transmitted to it, control C-568/GRD converts this into a two-phase voltage and sends it on to the azimuth indicator.

2-9. Radio Transmitter T-216/GR can be completely controlled from the local or remote positions. It is in effect a signal generator covering the same frequency range as the receiver R-278A/GR. The transmitter output is fed to Antenna AT-368/CRD-6, whose position with respect to both receiving antennas is accurately known. Thus the target transmitter is used to calibrate the system. Detailed information on Radio Transmitter T-216/GR will be found in the applicable handbook.

2-10. DIVERSITY OPERATION.

2-11. Diversity operation is accomplished by the use of the two antennas, the receiver, the azimuth indicator, and the comparator. The antennas are mounted at different heights (height diversity) so that the minimums of one antenna are, as far as possible, filled in by the maximums of the other antenna. Comparison of the two antenna r-f outputs is accomplished by switching the receiver periodically from one antenna to the other and comparing the corresponding receiver outputs. The "stronger" antenna supplies directional information for the long-time interval and the "weaker" antenna is sampled for 0.3 second. (See figure 2-1.)

2-12. With antenna No. 1 providing the stronger signal, as shown in figure 2-1, the operation is as follows:

a. K503 is closed by the comparator in such direction that antenna No. 1 is connected to the receiver input. K502 shorts antenna No. 2 to ground to minimize cross-talk.

b. K505 is de-energized by the comparison circuit applying the antenna No. 1 reference voltages to the stator windings of the azimuth indicator phasemeter.

c. The receiver output is simultaneously applied to the comparison circuit and, through K504, to the input of the azimuth indicator. The neon lamp on the indicator will light, indicating that it is now permissible to take a bearing reading.

d. This condition continues for the duration of the operating period.

e. At the end of the operating period, the timing circuit switches K502, K503, and K504 to their alternate positions. This is the sampling period and is maintained for 0.3 second.

f. The r-f output of antenna No. 2 is now applied to the receiver input.

g. Since K504 is open, the receiver output passes to only the comparison circuits.

h. Since there is no DF, which is the receiver output during the operating period only, applied to the azimuth indicator, the neon light is turned off and the phasemeter dial is free floating. It is not permissible to take a bearing reading at this time.

i. The comparison circuit compares the present receiver output with the receiver output stored during the operating period. If it finds that the receiver output due to antenna No. 2 is less than the stored output due to antenna No. 1, the above cycle will repeat itself with no change at the end of the sampling period. If the comparison circuit finds that the receiver output due to antenna No. 2 is greater than the stored output due to antenna No. 1, the cycle described above then reverses. Antenna No. 1 now becomes the sampled antenna and antenna No. 2 provides the bearing information to the azimuth indicator during the operating period.

2-13. SUMMARY.

a. K504 is always closed during the operating period and open during the sampling period.

b. A particular antenna will provide bearing information only if it is connected to the receiver during the operating period.

c. In order for the antennas to interchange their functions, the sampled antenna's signal must be greater than that of the operating antenna.

2-14. The receiver has a long-time-constant avc in order to hold the receiver gain relatively constant during the sampling period so that the correct ratio of signals is maintained.

2-15. THEORY OF OPERATION.

2-16. Two identical antennas are used in the system and are placed about 75 feet apart. One antenna height is adjusted to 20 feet and the other to 27 feet. Such an arrangement minimizes bearing errors caused by signal interference at the antennas between direct and ground-reflected waves.

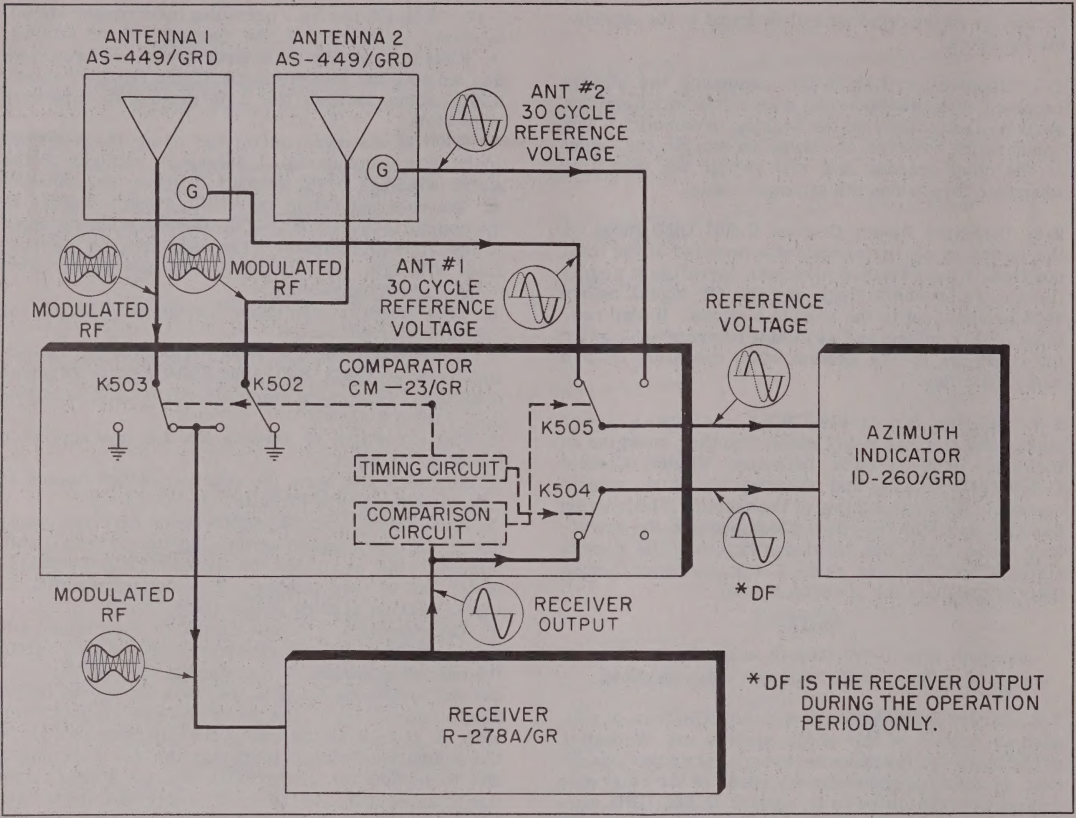


Figure 2-1. Radio Direction Finder AN/CRD-6 Diversity Operation, Simplified Block Diagram

2-17. The following description of single-antenna operation is useful in showing the need for diversity operation: Energy from the aircraft transmitting antenna reaches the DF antenna by two paths, one of which is direct, while the other is by reflection from the ground. At the antenna, the ground-reflected wave combines with the direct wave to give a resultant r-f field whose magnitude depends on the relative phases of the two signals. As the aircraft changes position with respect to the antenna, the r-f field strength at the antenna varies continuously from minimum to maximum and back again. When the field strength is at a minimum (null), the signal level may be too weak for a bearing reading to be taken. Moreover, under conditions where a reflection from nearby buildings or other structures over-rides the resultant of the direct and ground-reflected waves, an erroneous DF bearing may be obtained.

2-18. The succession of maximums and nulls produces a definite interference pattern for an antenna at a particular height. A second antenna mounted at a different height will not have the same interference pattern because the travel distance of the ground-reflected wave is different. This means that nulls do not occur at the same instant for the two antennas. Choice of antenna heights of 20 and 27 feet, respectively, is the result of careful analysis to obtain optimum overlapping of the two interference patterns so that nulls do not coincide. A horizontal separation of approximately 75 feet between antenna structures is used to minimize mast assembly reflections which might result in DF bearing errors.

2-19. OPERATION FROM THE LOCAL POSITION. The local control unit serves only to control the power to the antennas and all of the equipment mounted at the local position. During operation from the local station, the amplifier circuits in the local control unit do not have power supplied to them and are inoperative. (See figure 2-2.)

2-20. REMOTE STATION OPERATION. Figure 2-3 shows the passage of direction-finding and control signals throughout the complete system. If only one remote station is installed, Junction Box J-476/CRD-6 is not used.

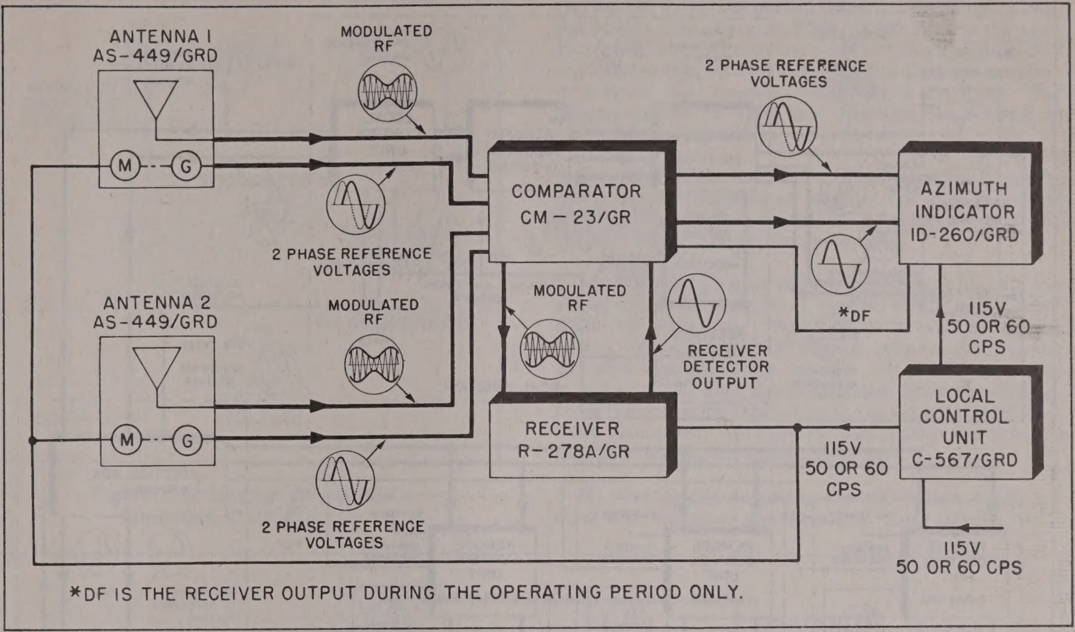


Figure 2-2. Radio Direction Finder AN/CRD-6 Local Station Operation, Simplified Block Diagram

2-21. FUNCTIONAL OPERATION OF ELECTRICAL COMPONENTS.

2-22. ANTENNA AS-449/GRD.

2-23. The antenna consists of a low-Q, wide-band coaxial dipole around which a parasitic cylindrical reflector is mechanically rotated at a speed of 1800 rpm. The length of the coaxial dipole is 19 inches. The reflector is 22 inches long. This latter dimension was chosen to make the reflector resonant at 215 mc, thus insuring correct directional information at the low end of the frequency range. The cylindrical reflector is composed of five vertical conducting strips one-eighth inch wide and spaced one-half inch apart on a radius of four inches. The spacing between the dipole and the reflector is 3-1/2 inches. The field pattern obtained in the horizontal plane with the dipole and reflector combination is unidirectional and essentially cardioidal in shape. Thus, upon rotation of the reflector, a modulation is imposed upon the received signal. The modulation frequency is equal to the speed of rotation of the reflector (30 cycles per second). The direction from which the r-f signal is received by the antenna determines the phase relationship between the modulation envelope and the reference voltage. (See figures 2-4 and 2-5.)

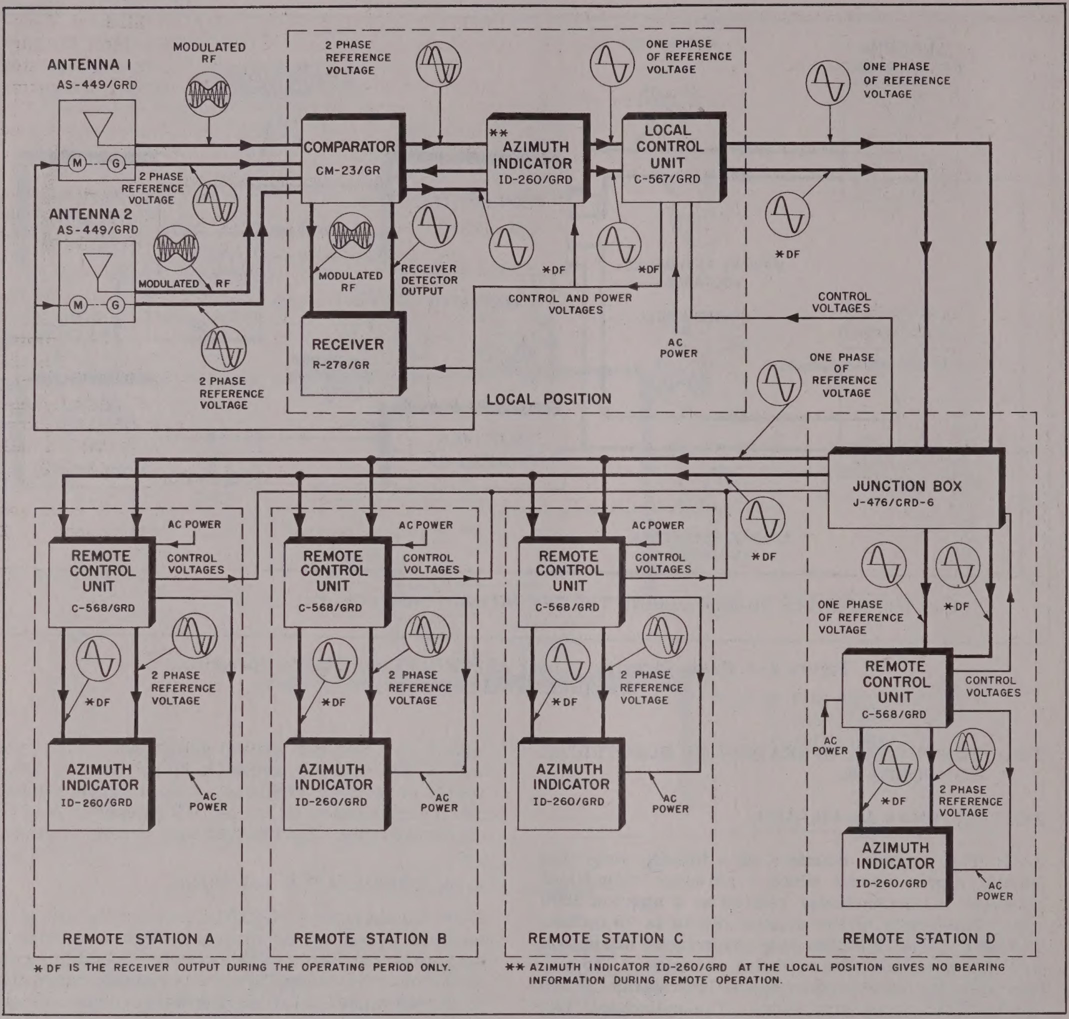
2-24. In figure 2-5, C201 and C202 are phase-shifting capacitors since B201 is a split-phase capacitor-start, capacitor-run hysteresis motor. Thermostat S-201 adds capacitor C-203 to the motor when the temperature is below freezing. C201 is used with a 60-cycle-per-second supply and C202 is used with a 50-cycle-per-second supply. When a 50-cps supply is used the frequency of the reference voltage and the modulation is 25 cps. J203 supplies power to the hazard lights. G201 is a permanent magnet generator.

2-25. COMPARATOR CM-23/GR.

2-26. Comparator CM-23/GR determines which antenna is providing the stronger signal and times the operation of the antenna relays and the disabling relay so that only this antenna provides bearing information to the Azimuth Indicator. The weaker antenna signal is sampled in alternation with the stronger signal. The sampling and operating intervals are timed by circuits included in the comparator.

2-27. COMPARATOR OPERATION. (See figure 2-6.)

2-28. First assume that the condition of relays K502 and K503 is as shown in figure 2-6. The output of antenna No. 1 is transmitted to the receiver input through relay K503. This signal is amplified and detected by the receiver and sent to V501 and the contacts of relay K504 of the comparator. V501 is a cathode follower to provide low input impedance for Z501. (The function of K504 will be treated later.) The input to V501 contains other audio frequencies in addition to the modulation caused by the rotating reflector. For simplicity, however, these frequencies are not shown in figure 2-6. This additional modulation is undesirable in the circuits following V501 and is removed by filter Z501. The output of Z501 is simultaneously applied to V502 and V503.



* DF IS THE RECEIVER OUTPUT DURING THE OPERATING PERIOD ONLY.

** AZIMUTH INDICATOR ID-260/GRD AT THE LOCAL POSITION GIVES NO BEARING INFORMATION DURING REMOTE OPERATION.

Figure 2-3. Radio Direction Finder AN/CRD-6 Remote Station Operation, Simplified Block Diagram

2-29. V502 is a duo-triode. One section acts as a voltage amplifier and the following section rectifies the output of the first section to provide avc to V503. V503 is a voltage amplifier whose gain is controlled by the avc output of V502. The avc time constant is long compared to the period of the 30 cycle receiver output. This serves to hold the gain of V503 relatively constant, thus maintaining the ratio of the signal strengths from antenna No. 1 and antenna No. 2. The avc bias applied to V503 varies directly with the strength of the stronger 30-cps signal. This limits the output of V503 and prevents V505 from being overdriven.

2-30. The output of V503 is rectified by V504 and is stored in the antenna storage circuit chosen by K502; in this case the antenna No. 1 storage circuit. Thus far, no signal has been stored in the antenna No. 2 storage circuit. Hence, V505 detects that antenna No. 1 is providing the stronger signal and operates to make, or keep, antenna No. 1 the operating antenna and antenna No. 2 the sampled antenna.

2-31. Before explaining the operation of V505, the relays shown in figure 2-6 and the manner in which they are operated will be discussed. All the relays with the exception of K505, are periodically opened and closed by the outputs from timing multivibrator V506. V506 provides a long pulse which determines the length of the operating period and a short pulse which determines the length of the sampling period.

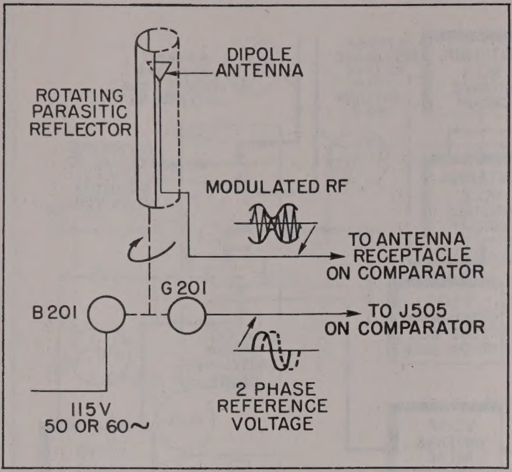

DIPOLE ANTENNA
ROTATING PARASITIC REFLECTOR
MODULATED RF
TO ANTENNA RECEPTACLE ON COMPARATOR
G 201
B 201
TO J505 ON COMPARATOR
2 PHASE REFERENCE VOLTAGE
115V 50 OR 60~

Figure 2-4. Antenna AS-449/GRD, Simplified Block Diagram

During the sampling period there is a third set of output pulses that energize K504. K505 selects the correct set of pulses from the output of the multivibrator and applies this set to V507. V507 is simply a vacuum-tube switch that operates relays K502 and K503. The pulses applied to V507 gate this tube, there being no current when a pulse is not present.

2-32. When K502 and K503 are not energized antenna No. 1 is the antenna being used by the system. When K502 and K503 are energized antenna No. 2 is the antenna being used by the system.

2-33. Returning to the case in question, with only the signal from antenna No. 1 stored, V505 must leave K505 de-energized. Thus the short positive timing pulses are applied to V507 and antenna No. 2 is the sampled antenna while antenna No. 1 the operating antenna. K505 also sends only the reference voltage from the operating antenna on to the azimuth indicator. K504 disconnects the receiver output from the azimuth indicator during the sampling period.

2-34. During the sampling period, relays K502 and K503 are energized and the signal from antenna No. 2

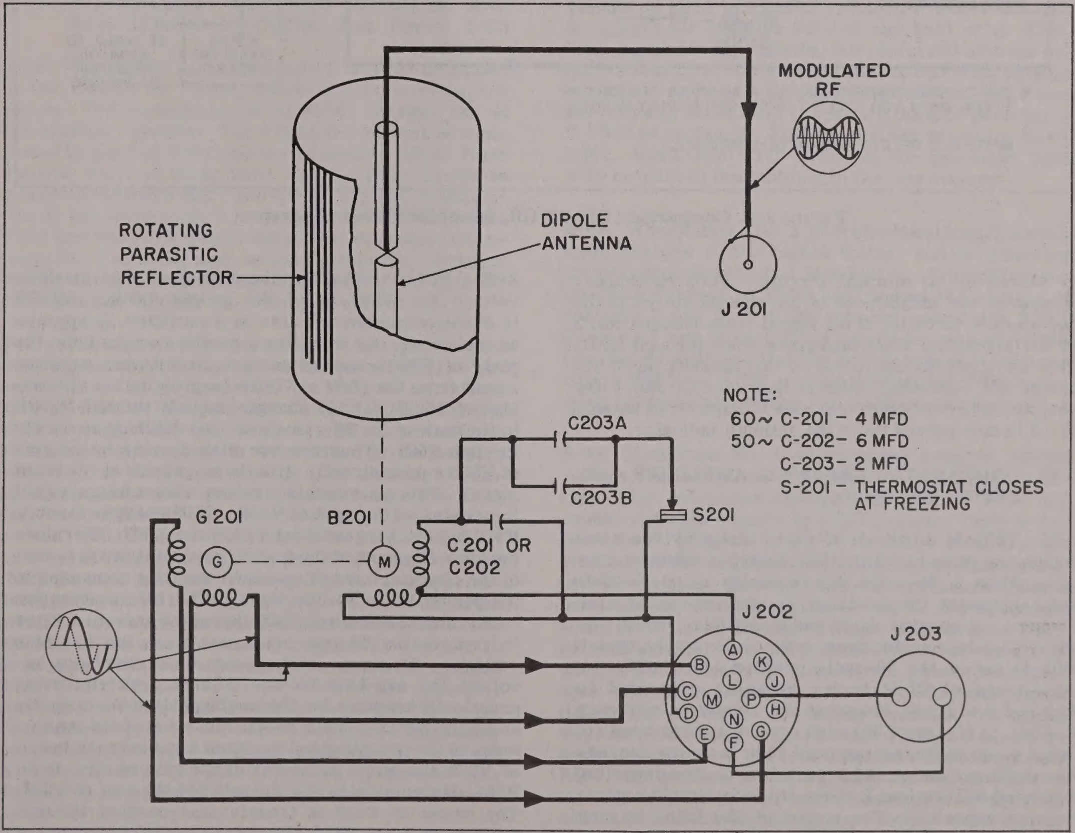
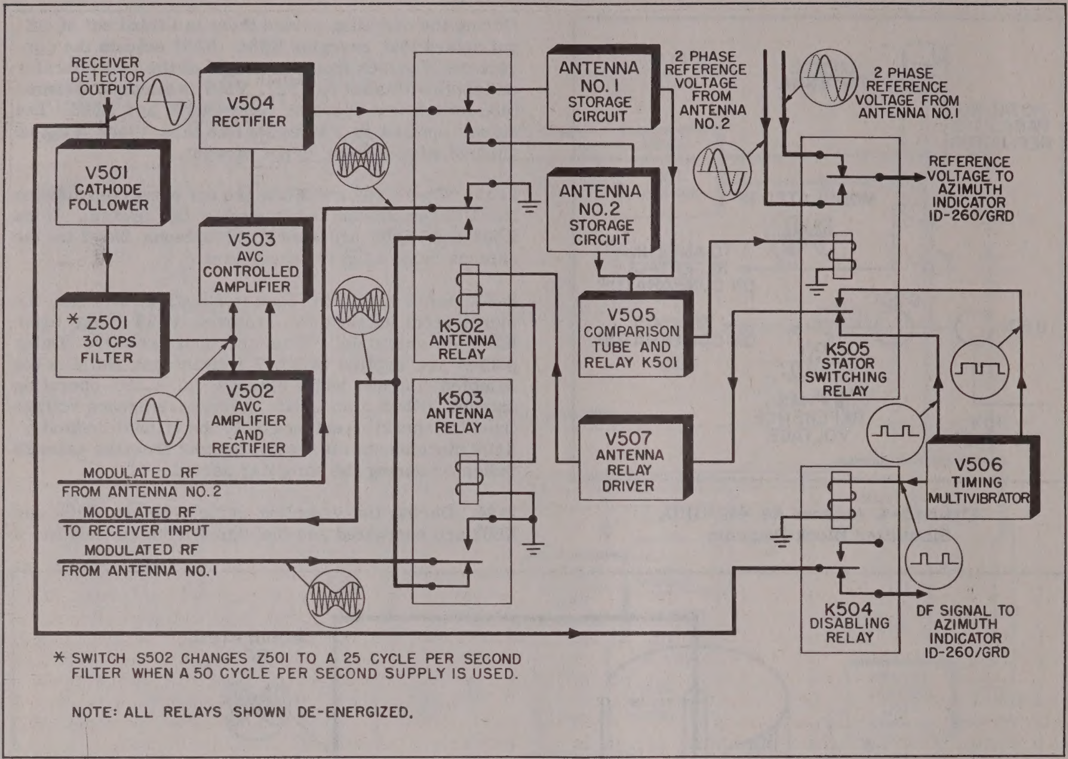


Figure 2-5. Antenna AS-449/GRD, Schematic Diagram


RECEIVER DETECTOR OUTPUT
V504 RECTIFIER
V501 CATHODE FOLLOWER
V503 AVC CONTROLLED AMPLIFIER
* Z501 30 CPS FILTER
V502 AVC AMPLIFIER AND RECTIFIER
MODULATED RF FROM ANTENNA NO. 2
MODULATED RF TO RECEIVER INPUT
MODULATED RF FROM ANTENNA NO. 1
K502 ANTENNA RELAY
K503 ANTENNA RELAY
ANTENNA NO. 1 STORAGE CIRCUIT
ANTENNA NO. 2 STORAGE CIRCUIT
2 PHASE REFERENCE VOLTAGE FROM ANTENNA NO. 2
2 PHASE REFERENCE VOLTAGE FROM ANTENNA NO. 1
REFERENCE VOLTAGE TO AZIMUTH INDICATOR ID-260/GRD
V505 COMPARISON TUBE AND RELAY K501
V507 ANTENNA RELAY DRIVER
K505 STATOR SWITCHING RELAY
V506 TIMING MULTIVIBRATOR
K504 DISABLING RELAY
DF SIGNAL TO AZIMUTH INDICATOR ID-260/GRD

* SWITCH S502 CHANGES Z501 TO A 25 CYCLE PER SECOND FILTER WHEN A 50 CYCLE PER SECOND SUPPLY IS USED.

NOTE: ALL RELAYS SHOWN DE-ENERGIZED.

Figure 2-6. Comparator CM-23/GR, Simplified Block Diagram

is stored in its storage circuit. V505 continually compares the magnitudes of the signals stored in the two storage circuits. If the signal from antenna No. 2 is the stronger, V505 energizes K505 through K501. This switches the operation so that antenna No. 2 becomes the operating antenna and antenna No. 1 the sampled while only the reference voltage from antenna No. 2 is now passed on to the azimuth indicator.

2-35. COMPARATOR CM-23/GR AMPLIFIER CIRCUITS. (See figure 2-7.)

2-36. V501 is a cathode follower that provides a low impedance input to filter Z501, a series resonant circuit. When a 60-cycle power supply is used, Z501 has a resonant frequency of 30 cps and extracts the 30-cycle component from noisy signals. When the AN/CRD-6 is operated from a 50-cycle supply, switch S502 is set at the 50-cycle position. This adds the capacitance of C502 to the capacitor connected to terminal 3 of filter, changing the resonant frequency of Z501 to 25 cps. Z501 also provides some amplification since there is a resonant rise in voltage across the condenser connected to terminal 3. The capacitor connected to terminal 2 of the filter is simply a grid-coupling capacitor. The output of the filter is then applied to the grid of V502A and through coupling capacitor C503 to the grid of V503.

2-37. V502A amplifies the signal so that the bias voltage for V503 is of the proper level. V502B is diode-connected and acts as a rectifier. It appears as a short across R507 for a positive output from the plate of V502A and as an open circuit for a negative output from the plate of V502A (neglecting the cathode bias of V502B). C505 charges rapidly through V502B to the peak of the 30-cps signal and discharges slowly through R507. Thus the avc bias applied to the grid of V503 varies directly with the magnitude of the input signal. This prevents distortion when a large signal is present on the grid of V503. C506 charges through R510 but discharges through R510 and R507. Therefore the time constant of the discharge circuit is twice that of the charging circuit and both are long compared to the period of the 30-cps signal. The RC combination consisting of R510 and C506 therefore acts as a filter to remove the 30-cps component from the avc bias voltage. Because of the long time constants involved, the avc bias voltage will vary slowly, being practically constant for the length of time taken by the sampling period. This keeps the ratio of the magnitudes of the operating and sampled signals in the output of V503 the same as it was at the grid of this stage. R507 also completes the d-c path for the grid of V503. The output of V503 is transformer-coupled through T501 to V504 and K502. Use of the transformer makes possible the double-ended output.

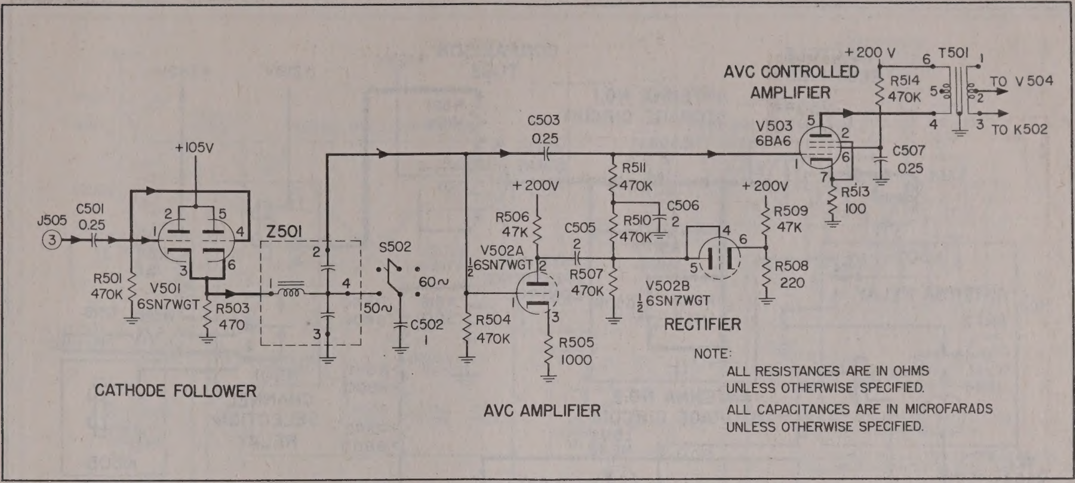


Figure 2-7. Comparator CM-23/GR Amplifier Circuits, Simplified Schematic Diagram

2-38. COMPARATOR CM-23/GR STORAGE AND COMPARISON CIRCUITS. (See figure 2-8.)

2-39. The 30-cps output from pin 2 of T501 is applied to the cathode of V504A, which is a diode-connected triode. The rectified output of V504A charges one of the storage circuits. The V504A d-c circuit is completed by pin 3 of T501 and the contacts of K502. When antenna No. 1 is being used the rectifier circuit is completed through R517 and C509. This RC combination is the antenna No. 1 storage circuit. When relays K502 and K503 are energized so that the output of antenna No. 2 is being used by the system, the rectifier circuit is completed through R518 and C508. This RC circuit is the antenna No. 2 storage circuit.

2-40. The two storage circuits are charged to the polarities shown in figure 2-8 by the rectified output of V504A. The grid circuit of V505 is completed through the two storage circuits in series. The two stored voltages add with polarities as shown and the grid-to-ground voltage is determined by the relative magnitude of the stored signals. This addition of voltages constitutes the comparison process. The time constants of the two storage circuits are long enough so that the voltage level of each is held practically constant during the sampling period for satisfactory comparison of voltages. A sampling period of approximately 0.3 second is the optimum value. With a shorter period there would be insufficient time for the d-c to build up in the storage capacitors and for the a-c to build up in Z501. A longer sampling time would permit too great a drop in potential in the storage capacitor that has stored the signal from the operating antenna. The result would be a loss in comparator sensitivity for sampling periods differing appreciably from 0.3 second. However, a plus-or-minus 10-percent difference in sampling period length can be tolerated.

2-41. Antenna preference control R519 is a cathode biasing potentiometer. Varying R519 determines the amount of grid-to-ground voltage of either polarity necessary for V505 to actuate and hold relay K501. With equal 30-cps signals, the preferred antenna requires less grid voltage than the unpreferred antenna to make it or keep it the operating antenna. R519 also serves as an adjustment to restore desired preference if V505 is replaced. Voltage divider resistors R540, R541, R542, and R543 stabilize the operation V505 with respect to fluctuations in the line voltage.

2-42. When antenna No. 2 provides the stronger signal, C508 charges to the higher voltage and the resultant grid-to-ground potential is negative. This decreases the plate current of V505 and causes the closing of contacts 2 and 3 on K501, thereby energizing K505. Contacts 1 and 11 on K505 close and the plate of V506B (see figure 2-9) supplies the keying pulses for antenna relays K502 and K503, making antenna No. 2 the operating antenna and antenna No. 1 the sampled.

2-43. If antenna No. 1 supplies the greater 30-cps voltage, the sum of the two capacitor voltages is positive. This increases the plate current of V505 and causes contacts 3 and 4 on K501 to close. K505 is de-energized. Contacts 2 and 11 on K505 close and the plate of V506A supplies the keying pulses, making antenna No. 1 the operating antenna and antenna No. 2 the sampled. In addition to selecting the keying pulses, stator-switching relay K505 sends only antenna No. 1 reference voltages to the azimuth indicator when it is de-energized, and only antenna No. 2 reference voltages when it is energized. Switch S503, when positioned for automatic operation, connects the B+ to V507 and the timing multivibrator V506, and also connects the plate of V507 to antenna relays K502 and K503. In the other positions, S503 makes one antenna the used antenna to the complete exclusion of the other, and lights the corresponding neon lamp, either I501 or I502. These lamps also operate during automatic operation, always indicating the antenna being used.

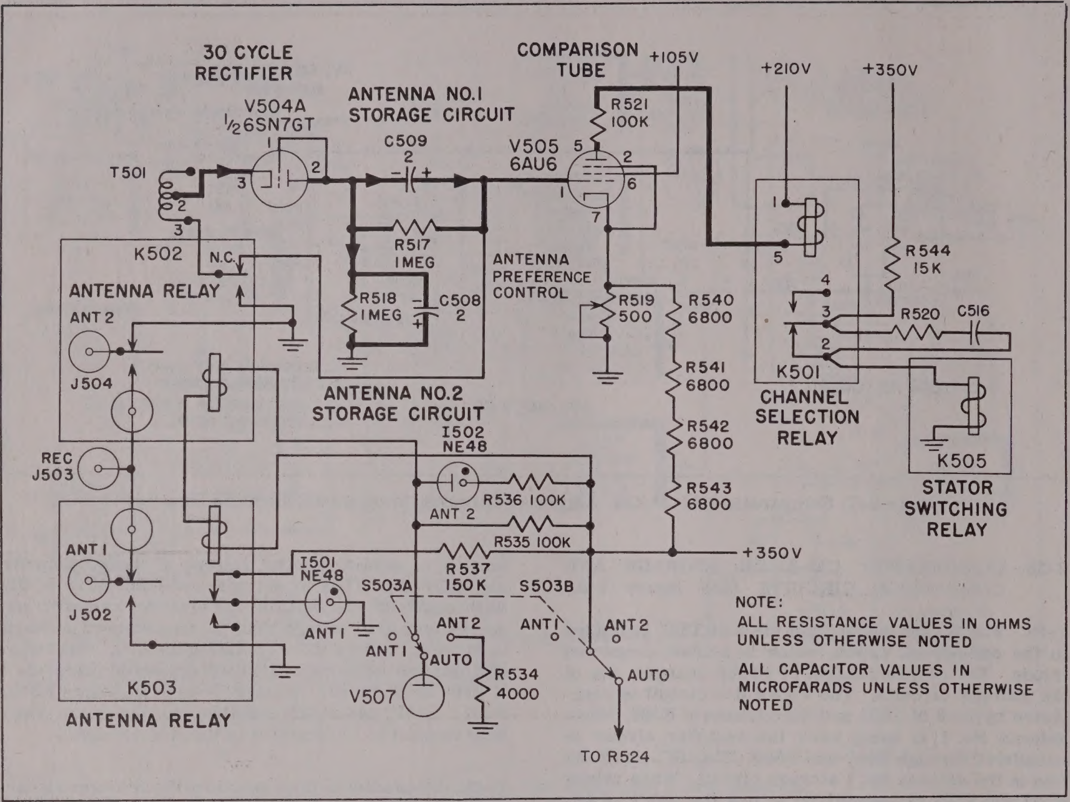


Figure 2-8. Comparator CM-23/GR Storage and Comparison Circuits, Simplified Schematic Diagram

2-44. COMPARATOR CM-23/GR TIMING CIRCUITS. (See figure 2-9.)

NOTE

The actual waveforms are not as square as shown in figure 2-9.

2-45. The timing of all functions of the comparator is accomplished by an a-c coupled, unsymmetrical, free-running multivibrator. V506 is a duo-triode with both sections used for the multivibrator. The timing circuits within the multivibrator consist of C511 in series with R529 and R530 (operating period) and C513 in series with R527 and R528 (sampling period). By varying R527 or R529, the duration of the sampling period and the duration of the operating period may be changed independently of one another. The current pulse in the cathode of V506B always has the same duration as the sampling period and drives K504. In this way K504 opens and removes the DF signal during the sampling period. R522 and R526 act as grid-leak resistors for V507. C510 and C514 are grid-coupling capacitors and prevent the B+ voltage from being aplied to the grids of V507.

2-46. COMPARATOR CM-23/GR POWER SUPPLY. (See figure 2-10.)

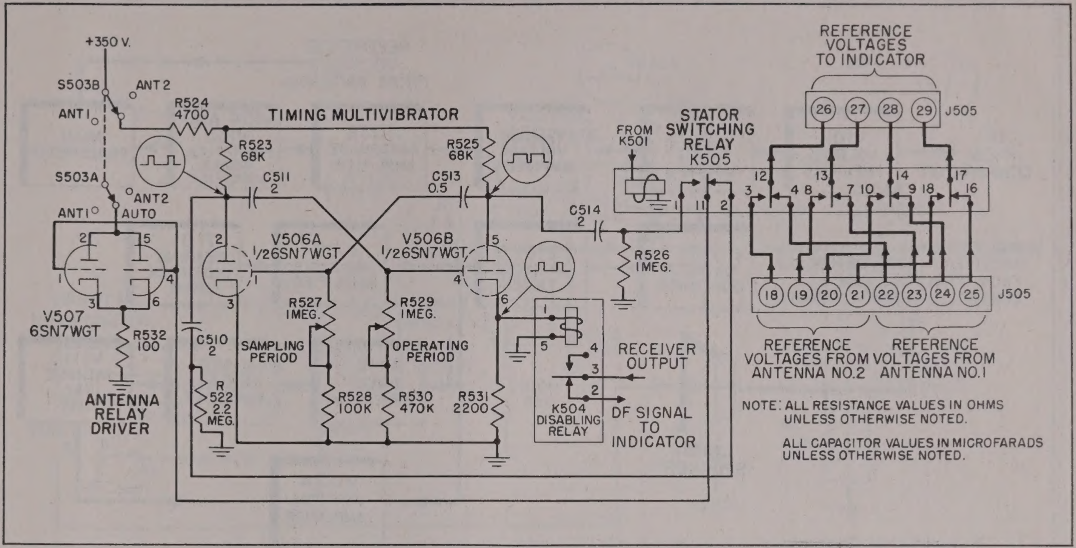
2-47. The comparator power supply consists of full-wave rectifier V508, whose output is filtered by a pi-type LC filter consisting of C504, C515, and L501. Three output voltages are provided: 108 volts and 216 volts regulated by voltage regulator tubes V509 and V510, and 350 volts, unregulated.

2-48. AZIMUTH INDICATOR ID-260/GRD.

2-49. The azimuth indicator contains the phasemeter, which provides the bearing indication, as well as a neon lamp, a cathode ray oscilloscope and a speaker. The neon lamp and the oscilloscope show whether or not there is a DF signal present in the system. When there is no signal present the dial of the phasemeter is free-floating and so gives some random reading.

2-50. AZIMUTH INDICATOR ID-260/GRD BLOCK DIAGRAM. (See figure 2-11.)

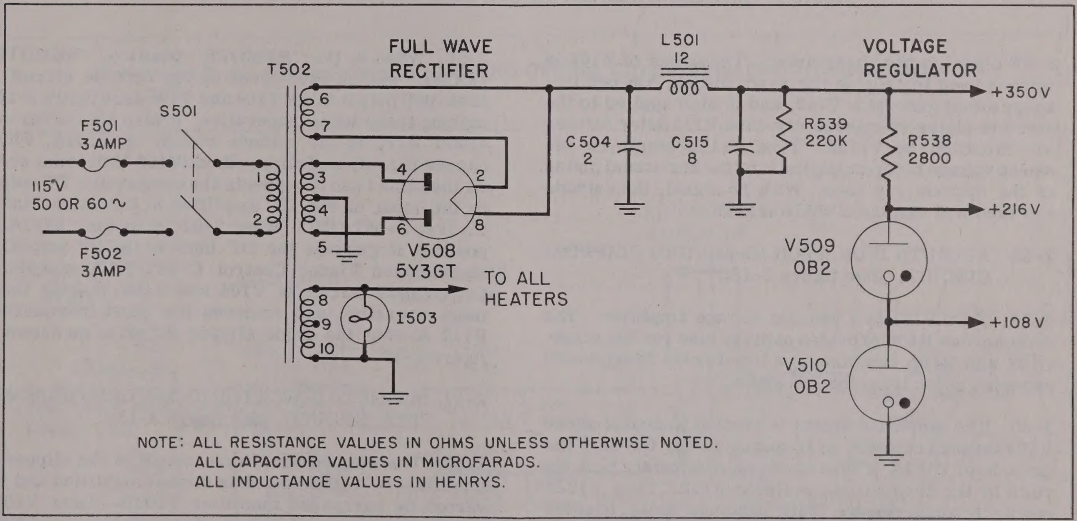
2-51. The DF signal from the comparator is so amplified by V101 that the double-diode clipper V102



NOTE: ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.

ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE NOTED.

Figure 2-9. Comparator CM-23/GR Timing Circuits, Simplified Schematic Diagram



NOTE: ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE NOTED.
ALL CAPACITOR VALUES IN MICROFARADS.
ALL INDUCTANCE VALUES IN HENRYS.

Figure 2-10. Comparator CM-23/GR Power Supply, Schematic Diagram

always has a large enough voltage presented to it within the range of usable signal levels. Speaker LS101 provides for monitoring the plane transmission while taking bearing readings. V102 is a double-diode clipper, one section of which is biased. The input to V103A and V107 is, therefore, a clipped sine wave of constant amplitude over most of the range of useable signal level. V103B drives the push-pull output stage composed of V104 and V105 that supplies the rotor of phasemeter M101. The two-phase 30-cps reference voltages are applied directly to the stator windings of phasemeter M101. The phasemeter will respond to only the 30-cps component of the rotor input voltage. Therefore, no filter is necessary in the phasemeter channel.

2-52. Filter Z101 is a series resonant 30-cps filter identical with Z501. Its output is a 30-cps sine wave which is amplified by V108. The output of V108 lights bearing indicator lamp I101, showing the presence of

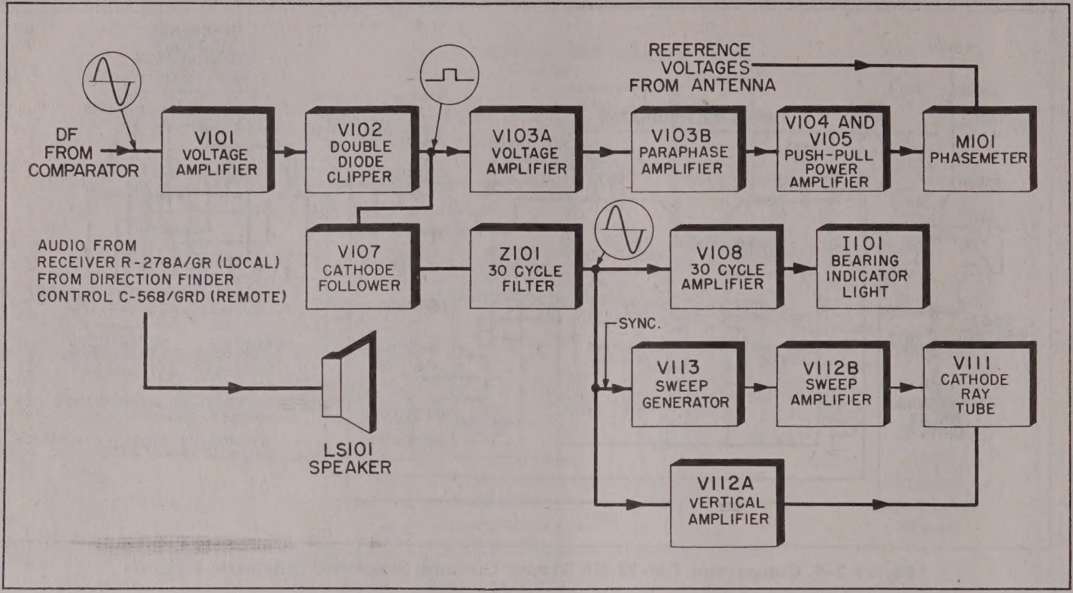


Figure 2-11. Azimuth Indicator ID-260/GRD, Simplified Block Diagram

a DF signal in the phasemeter. The output of Z101 is further used to provide the sync voltage for oscilloscope sweep generator V113, and is also applied to the vertical plates of cathode ray tube V111 after further amplification by V112A. Tube V112B amplifies the sweep voltage before applying it to the horizontal plates of the cathode ray tube. With no signal, the cathode ray tube will display a horizontal line.

2-53. AZIMUTH INDICATOR ID-260/GRD CLIPPING CIRCUIT. (See figure 2-12.)

2-54. Tube V101 is a pentode voltage amplifier. The drop across R106 provides cathode bias for the stage. C102 and R105 combine as a low-bypass filter which removes noise from the DF signal.

2-55. The amplified signal is coupled to double-diode V102 through resistor R110 and capacitor C105A. The cathode of V102A is biased at approximately plus six volts by the drop across resistor R112. Thus V102A conducts whenever its plate becomes more positive than six volts, and clips the positive peaks of the amplified DF signal. Since its plate is connected to ground, V102B conducts whenever its cathode becomes negative with respect to ground, completely clipping off the negative swing of the DF signal.

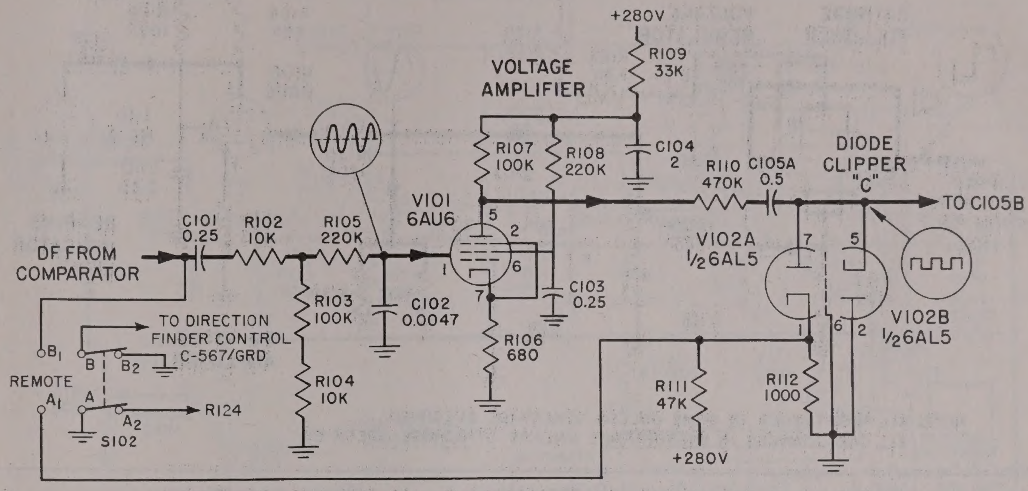
NOTE

The waveform at point ''C'' may not be as square as it appears in figure 2-12. Its squareness depends upon the magnitude of the signal at the plate of V101. The larger the signal to be clipped, the more square the resulting waveform.

2-56. When in the ''REMOTE'' position, ''REMOTE-LOCAL'' switch S102 opens up the cathode circuit of push-pull output tubes V104 and V105 (see figure 2-13), making these tubes inoperative. It also shorts out resistor R112 in the cathode circuit of V102A, which causes the output of clipper diode V102 to become zero. At the same time it connects the comparator DF output to the input of the DF amplifier in Direction Finder Control C-567/GRD. When S102 is in the ''LOCAL'' position it grounds the DF input to the DF amplifier in Direction Finder Control C-567/GRD, completes the cathode circuit of V104 and V105, making these tubes operative, and removes the short from across R112 so that the diode clipper output is as shown in figure 2-12.

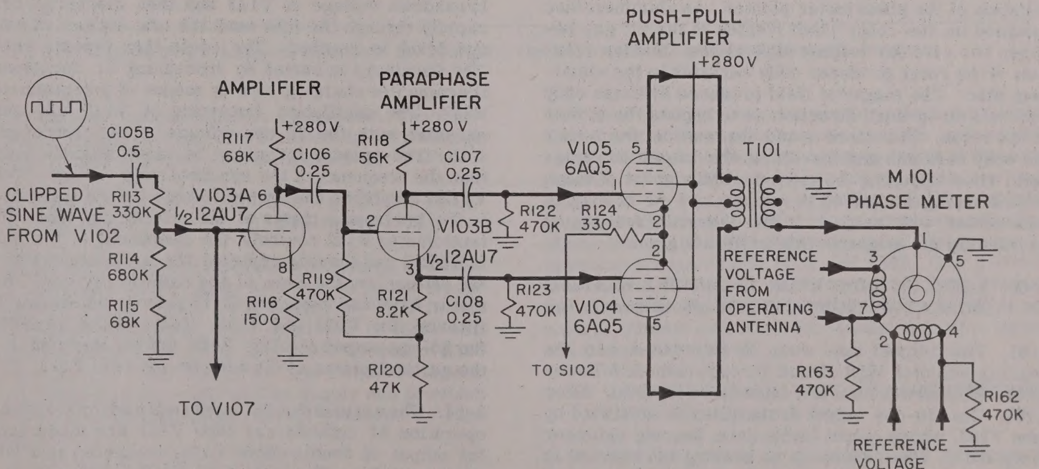
2-57. AZIMUTH INDICATOR ID-260/GRD PHASEMETER CIRCUIT. (See figure 2-13.)

2-58. The clipped sine wave output of the clipper is amplified by V103A and then further amplified and inverted by paraphase amplifier V103B. Tube V103B drives the push-pull output stage consisting of V104 and V105. The push-pull output of these two tubes is transformer-coupled through T101 to the rotor of phasemeter M101. The reference voltages from the operating antenna excite the stator windings of the phasemeter. The two stator windings of the phasemeter are in space quadrature. Therefore, the two-phase reference voltage sets up a rotating field in the stator of the phasemeter. The rotating field produces a sinusoidally varying magnetic field at any given point on the stator circumference. The 30-cps component of the rotor voltage produces a periodically varying magnetic field in the rotor. The rotor always assumes a position which places its varying magnetic



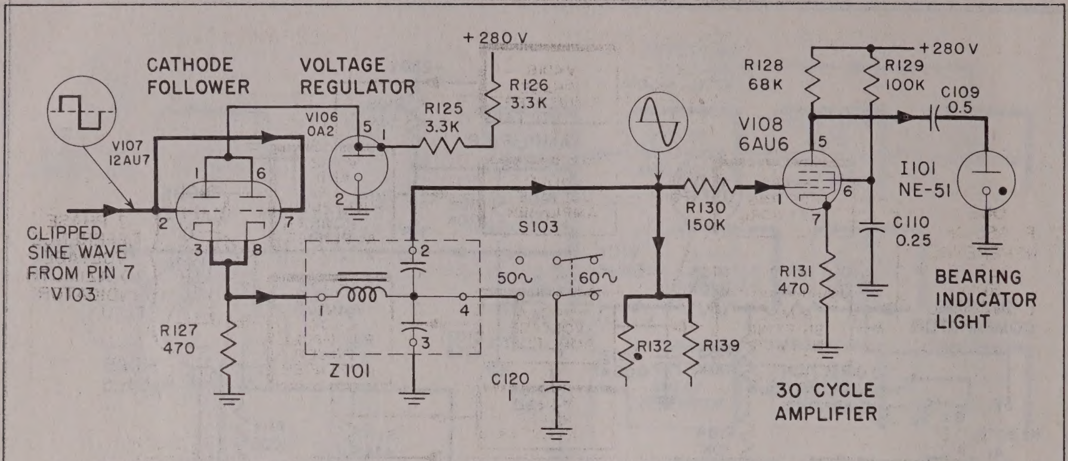
NOTE: ALL RESISTANCES IN OHMS UNLESS OTHERWISE SPECIFIED.
ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

Figure 2-12. Azimuth Indicator ID-260/GRD Clipping Circuit, Simplified Schematic Diagram



NOTE: ALL RESISTANCES IN OHMS UNLESS OTHERWISE SPECIFIED.
ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

Figure 2-13. Azimuth Indicator ID-260/GRD Phasemeter Circuit, Simplified Schematic Diagram



NOTE: ALL RESISTANCES IN OHMS UNLESS OTHERWISE SPECIFIED.
ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

Figure 2-14. Azimuth Indicator ID-260/GRD Bearing Indicator Light Circuit, Simplified Schematic Diagram

field in alignment with the varying magnetic field of the stator. The position of the point of alignment on the stator circumference is determined by the phase relationship between the rotor and stator voltages. It is therefore possible to calibrate the phasemeter dial in degrees and mount a pointer on the rotor to provide the desired bearing information.

2-59. Magnetic damping is used to reduce undue oscillation of the phasemeter pointer. An aluminum disc mounted on the rotor shaft rotates in the air gap between two circular magnet assemblies. Sudden rotation of the rotor produces eddy currents in the aluminum disc. The magnetic field produced by these eddy currents is in such direction as to oppose the motion of the rotor. The more rapid the motion, the larger the eddy currents and therefore, the larger the magnetic field opposing the motion. The amount of magnetic damping is adjusted by rotating one set of magnet assemblies with respect to the other, increasing or decreasing the magnetic flux in the air gap.

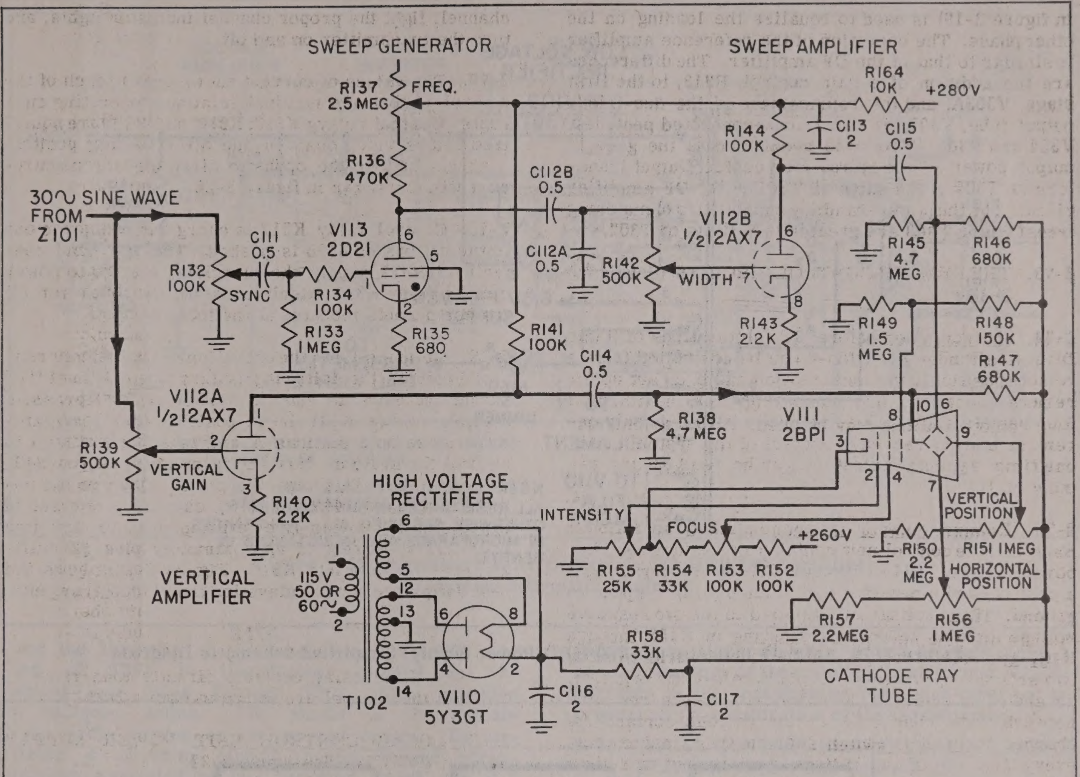
2-60. AZIMUTH INDICATOR ID-260/GRD BEARING INDICATOR LIGHT CIRCUIT. (See figure 2-14.)

2-61. The clipped sine wave is introduced into the bearing indicator light circuit through cathode follower V107. This provides a low impedance input for filter Z101. The 30-cps output of the filter is amplified by tube V108, whose output lights neon bearing indicator lamp I101. When there is no bearing information in the system, I101 is extinguished.

2-62. AZIMUTH INDICATOR ID-260/GRD OSCILLOSCOPE AND HIGH VOLTAGE POWER SUPPLY CIRCUIT. (See figure 2-15.)

2-63. The output of 30-cps filter Z101, in addition to providing the excitation for the bearing indicator light, is also applied across potentiometers R132 and R139. Potentiometer R132 determines the magnitude of the 30-cps voltage applied to the grid of the sweep generator V113 for the purpose of synchronization. Tube V113 is a shield-grid thyratron connected as a relaxation oscillator. The timing circuit consists of R136 and R137 in series with C112A and C112B. C112A and C112B are charged by the B+ supply through R136 and R137. Capacitors C112A and C112B charge to the breakdown voltage of V113 and then discharge very rapidly through the tube until the tube extinction voltage level is reached. The cycle then repeats itself. The frequency is varied by increasing or decreasing the capacitor charging rate by means of potentiometer R137. The oscillation frequency of V113 will synchronize with the 30-cps voltage on the control grid if the free-running frequency is made slightly lower than the frequency of the synchronizing voltage. Tube V112B amplifies the sweep voltage before applying it to the horizontal plates of the cathode ray tube. Potentiometer R142 controls the magnitude of the input to V112B and thereby controls the horizontal width of the pattern on the face of the cathode ray tube. Resistor R164 and capacitor C113 provide additional B+ filtering for V112 and V113. Tube V112A amplifies the 30-cps output of filter Z101 before applying it to the vertical plates of the cathode ray tube V111.

2-64. The various d-c voltages required for the proper operation of cathode ray tube V111 are taken from the output of double-diode V110, connected as a full-wave rectifier. The output of V110 is filtered by a pi-type RC filter consisting of capacitors C116, C117 and resistor R158. Resistor R158 is used in this filter instead of a choke coil because of the small current drain and the high voltage required. Resistors R145 to R157, inclusive, constitute several voltage divider networks that provide the proper operating potentials



NOTE: ALL RESISTANCES IN OHMS UNLESS OTHERWISE SPECIFIED.
ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

Figure 2-15. Azimuth Indicator ID-260/GRD Oscilloscope, Simplified Schematic Diagram

at the various cathode ray tube electrodes. The functions of the potentiometers included in this voltage divider circuit are indicated in figure 2-15.

2-65. AZIMUTH INDICATOR ID-260/GRD LOW VOLTAGE POWER SUPPLY. (See figure 2-16.)

2-66. Tube V109 is a double diode connected as a full-wave rectifier to the same winding on power transformer T102 as V110. The output of V109 is filtered by an L-type LC filter consisting of choke coil L101 and capacitors C118 and C119. Resistor R159 serves as a bleeder resistor. The output voltage is lower than that of the high-voltage supply and provides B+ voltages for all tubes except cathode ray tube V111.

2-67. DIRECTION FINDER CONTROL C-567/GRD. (See figure 2-17.)

2-68. In addition to containing a switch to turn on the power to all the components at the local position, local control unit C-567/GRD amplifies the DF and reference voltages before sending them out to the remote stations. The local control unit also contains the relays which are operated from the remote stations and provide remote control of the components mounted at the local position. The DF and reference voltages are each amplified by a separate amplifier. Each amplifier provides a push-pull output to an output transformer whose output is coupled to the spiral-four cable by matching transformers T302 and T303. The d-c control currents from the remote stations pass through the matching transformers to the control relays and control channel selection, the channel indicator lights, and transmitter on-off.

2-69. LOCAL CONTROL UNIT DF AMPLIFIER CIRCUIT. (See figure 2-18.)

2-70. The DF signal is amplified and inverted by V301A and V301B. The outputs of these two tubes drive power amplifiers V302A and V302B, which are connected in push-pull. T301 is a high-quality audio output transformer. Resistors R309 and R310 are voltage dividers. The voltage across R310 is fed back over the whole amplifier to the cathode of V303 to provide negative feedback. This increases the stability

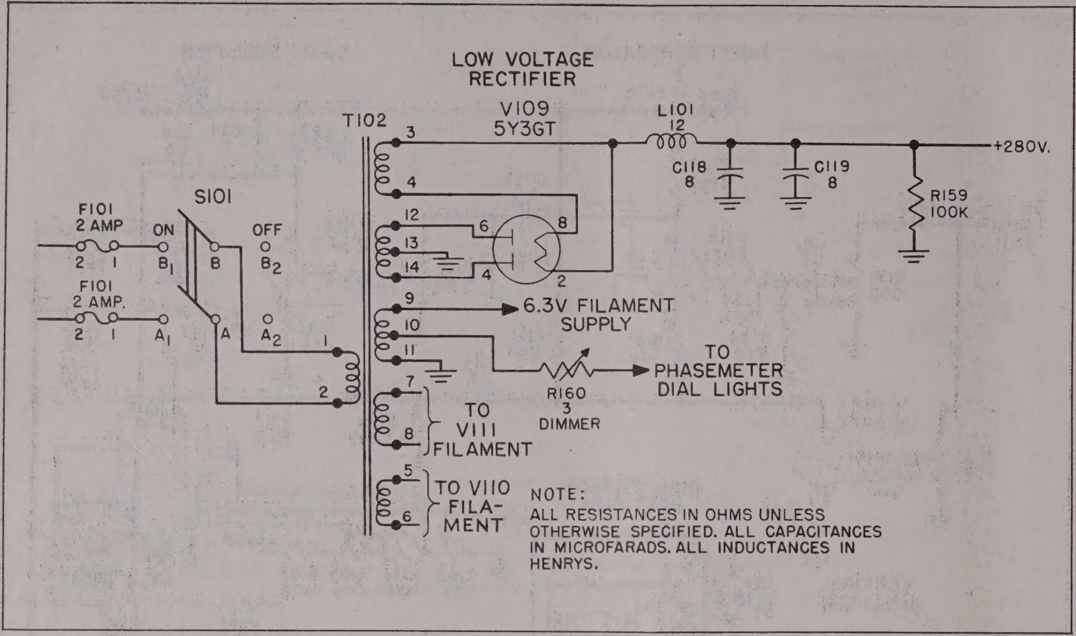


Figure 2-16. Azimuth Indicator ID-260/GRD Power Supply, Simplified Schematic Diagram

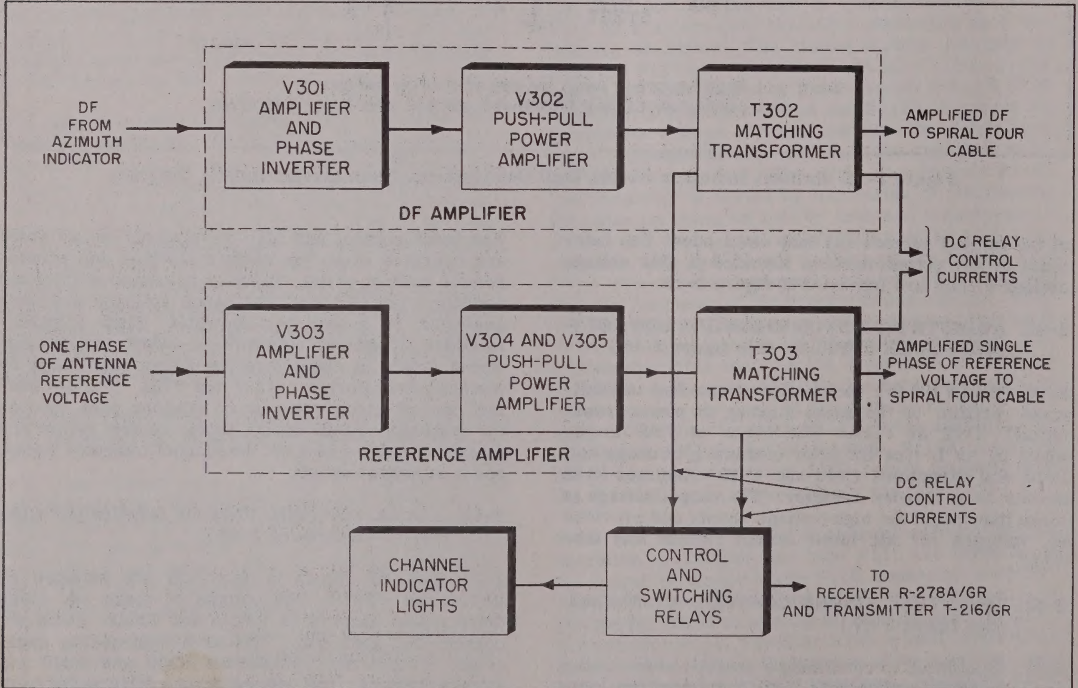
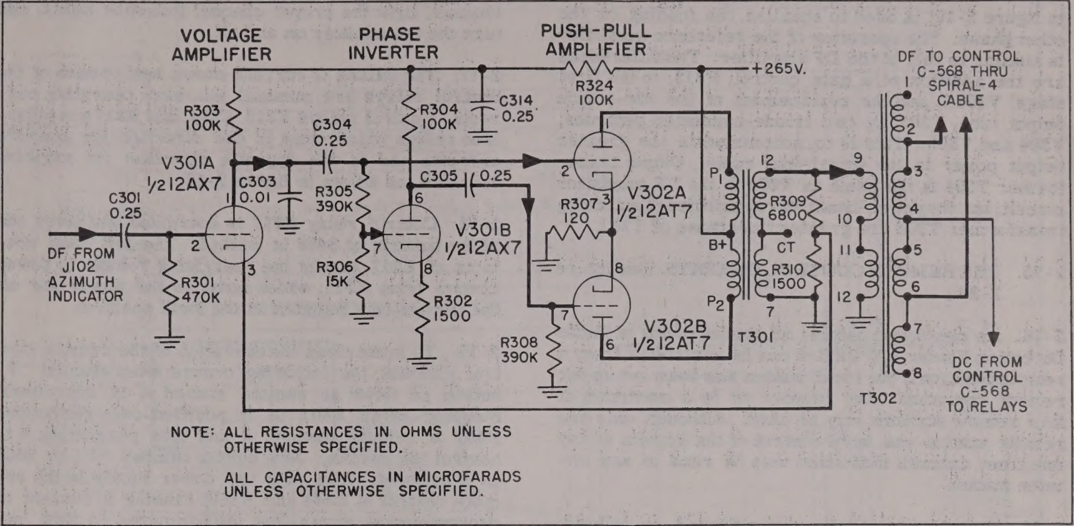

DF FROM AZIMUTH INDICATOR
V301 AMPLIFIER AND PHASE INVERTER
V302 PUSH-PULL POWER AMPLIFIER
T302 MATCHING TRANSFORMER
AMPLIFIED DF TO SPIRAL FOUR CABLE
DF AMPLIFIER
DC RELAY CONTROL CURRENTS
ONE PHASE OF ANTENNA REFERENCE VOLTAGE
V303 AMPLIFIER AND PHASE INVERTER
V304 AND V305 PUSH-PULL POWER AMPLIFIER
T303 MATCHING TRANSFORMER
AMPLIFIED SINGLE PHASE OF REFERENCE VOLTAGE TO SPIRAL FOUR CABLE
REFERENCE AMPLIFIER
DC RELAY CONTROL CURRENTS
CHANNEL INDICATOR LIGHTS
CONTROL AND SWITCHING RELAYS
TO RECEIVER R-278A/GR AND TRANSMITTER T-216/GR

Figure 2-17. Direction Finder Control C-567/GRD, Simplified Block Diagram



NOTE: ALL RESISTANCES IN OHMS UNLESS OTHERWISE SPECIFIED.

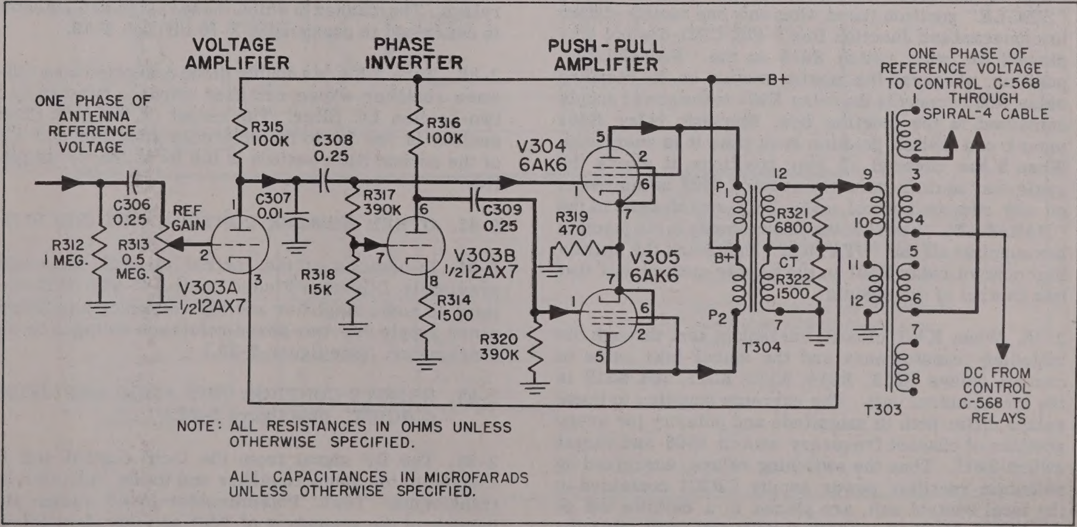
ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

Figure 2-18. Direction Finder Control C-567/GRD DF Amplifier, Simplified Schematic Diagram

and the linearity of the amplifier. The DF output of T301 is transformer-coupled to the spiral-four cable through T302. This provides a balanced output. The shield of the spiral-four cable serves as the ground return. By utilizing a phantom circuit (center-tapped transformer connected to two balanced lines), the d-c control currents use the same conductors as are used for the DF signal. Since these conductors are balanced with respect to each other, as are the windings of the matching transformer, the d-c currents in the transformer buck each other out and prevent any d-c saturation of the transformer.

2-71. LOCAL CONTROL UNIT REFERENCE AMPLIFIER CIRCUIT. (See figure 2-19.)

2-72. Only one phase of the reference voltage is amplified by the reference amplifier. R311 (not shown



NOTE: ALL RESISTANCES IN OHMS UNLESS OTHERWISE SPECIFIED.

ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

Figure 2-19. Direction Finder Control C-567/GRD Reference Amplifier, Simplified Schematic Diagram

in figure 2-19) is used to equalize the loading on the other phase. The operation of the reference amplifier is similar to that of the DF amplifier. The differences are the addition of a gain control, R313, to the first stage, V303A, and the replacement of the duo-triode output tube, V302, by two triode-connected pentodes, V304 and V305. This is to accommodate the greater output power to the spiral-four cable. Output transformer T304 is the same as T301 in the DF amplifier circuit, but the power-handling capabilities of matching transformer T303 are greater than those of T302.

2-73. THE REMOTE CONTROL CIRCUITS. (See figure 2-20.)

2-74. As mentioned before, all the functions of Radio Direction Finder AN/CRD-6 can be controlled from a remote position if the local station has been set up for remote operation. Any number up to a maximum of four remote stations may be used. Although only one remote station can have control of the system at any one time, azimuth indication may be read at any remote station.

2-75. Remote control is accomplished as follows: Each remote control unit contains a selenium rectifier power supply, CR401 through CR404, supplying both a positive and a negative d-c voltage with respect to ground. These voltages are applied to the two resistive voltage dividing networks consisting of R453 through R461 and R444 through R452. The networks provide two sets of d-c currents, one positive and one negative, as shown in figure 2-20. The ends of the resistive networks are connected to the various contacts of channel frequency switch S408 in such fashion that every time one of the buttons is depressed there is a unique set of d-c potentials present at terminals 7 and 9 of K401. In order to transmit the control signals to the local control unit, relay K401 must be closed. This relay is energized whenever switch S410 is in the "SINGLE" position (used when only one remote station is connected and Junction Box J-476/CRD-6 is not employed) or, with switch S410 in the "PARALLEL" position, whenever the moving contact on the stepping relay K601 connects the relay K401 to the power supply contained in the junction box. Stepping relay K601 moves one switch position each time it is energized. When it has covered all four positions, it starts the cycle over again the next time switch S406 is depressed on any remote control unit. With switch S410 in the "PARALLEL" position the power supply in the junction box supplies all the "STATION" lights and the spiral-four control relay K401 in the remote control unit that has control of the system.

2-76. When K401 closes, current is sent through the matching transformers and the spiral-four cable to control relays K313, K314, K315, K317, and K318 in the local control unit. The currents supplied to these relays differ both in magnitude and polarity for every position of channel frequency switch S408 and target switch S407. Thus the switching relays, energized by selenium rectifier power supply CR301 contained in the local control unit, are placed in a definite set of conditions for each position of S407 and S408. Switching relays K301 through K310, K312, K316, and K319 thus tune the receiver and transmitter to the desired channel, light the proper channel indicator lights, and turn the transmitter on and off.

2-77. The values of current shown next to each of the control relays are nominal minimum operating currents. Control relays K313, K314, and K317 are polarized relays which close in one direction for positive currents and in the opposite direction for negative currents, as shown in figure 2-20.

2-78. Control relay K317 is energized whenever one of the buttons on S408 is pushed. The left hand contacts of K317 supply the energizing voltage to power control relay K311, which turns on the power for all the components mounted at the local position.

2-79. To make clear the operation of the remote control circuits, the following occurs when channel "7" button on S408 at remote station A is depressed: Stepping relay K601 is in position one, energizing K401 at remote stations A and thus permitting it to control the system. Now button number "7" on S408 is depressed. This taps the power supply in the remote control of R444 and R460, causing a current of approximately minus five milliamperes to flow into K317 and a current of approximately plus 12 milliamperes to flow into K315. Figure 2-21 shows the resulting state of the relays for these input currents.

NOTE

Only those relay contacts directly concerned with the channel are shown in figure 2-21.

2-80. LOCAL CONTROL UNIT POWER SUPPLY CIRCUIT. (See figure 2-22.)

2-81. Selenium rectifier CR301 is connected as a full-wave bridge. Its rectified output is not filtered, but is applied directly to coils of the appropriate switching relays. The manner in which these relays are selected is described in paragraphs 2-75 through 2-79.

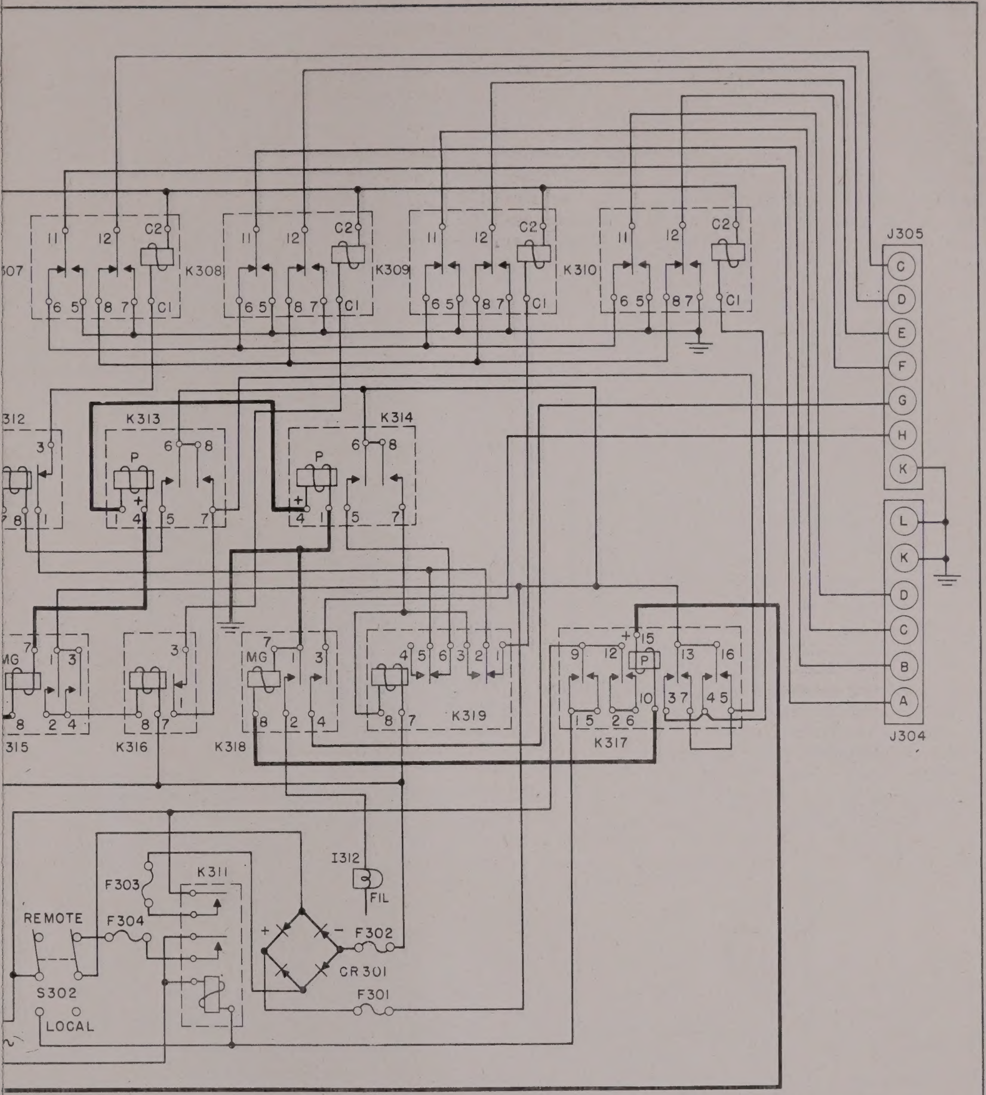
2-82. Tube V306 is a double diode connected as a full-wave rectifier whose rectified output is filtered by a two-section LC filter. The output of the first filter section is the B+ to the reference amplifier and that of the second filter section is the B+ to the DF amplifier.

2-83. OTHER REMOTE CONTROL UNIT CIRCUITS.

2-84. In addition to the control circuits discussed previously, Direction Finder Control C-568/GRD contains an audio amplifier and two reference amplifiers which supply the two-phase reference voltages to the phasemeter. (See figure 2-23.)

2-85. REMOTE CONTROL UNIT AUDIO AMPLIFIER CIRCUIT. (See figure 2-24.)

2-86. The DF signal from the local control unit is coupled to the audio amplifier and to the indicator by transformer T407. Potentiometer R462 varies the loading of the secondary of T407 and thus determines the magnitude of the DF voltage sent to the indicator and to the first stage of the audio amplifier.



CHANNEL

DE	1	2	3	4	5	6	7	8	9	10
		X			X	X		X	X	X
			X			X	X		X	X
				X			X	X		X
	X				X			X	X	

TE: X INDICATES WIRE GROUNDED—RADIO RECEIVER R278A/GR FOR REMOTE OPERATION.

NOTE: ALL RESISTANCES IN OHMS AND CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

ALL RELAYS SHOWN UNENERGIZED.

SEE TABLE 6-2 FOR CONTROL RELAY ENERGIZING AND DE-ENERGIZING CURRENTS.

in figure 2-19) is used to equalize the loading on the other phase. The operation of the reference amplifier is similar to that of the DF amplifier. The differences are the addition of a gain control, R313, to the first stage, V303A, and the replacement of the duo-triode output tube, V302, by two triode-connected pentodes, V304 and V305. This is to accommodate the greater output power to the spiral-four cable. Output transformer T304 is the same as T301 in the DF amplifier circuit, but the power-handling capabilities of matching transformer T303 are greater than those of T302.

2-73. THE REMOTE CONTROL CIRCUITS. (See figure 2-20.)

2-74. As mentioned before, all the functions of Radio Direction Finder AN/CRD-6 can be controlled from a remote position if the local station has been set up for remote operation. Any number up to a maximum of four remote stations may be used. Although only one remote station can have control of the system at any one time, azimuth indication may be read at any remote station.

2-75. Remote control is accomplished as follows: Each remote control unit contains a selenium rectifier power supply, CR401 through CR404, supplying both a positive and a negative d-c voltage with respect to ground. These voltages are applied to the two resistive voltage dividing networks consisting of R453 through R461 and R444 through R452. The networks provide two sets of d-c currents, one positive and one negative, as shown in figure 2-20. The ends of the resistive networks are connected to the various contacts of channel frequency switch S408 in such fashion that every time one of the buttons is depressed there is a unique set of d-c potentials present at terminals 7 and 9 of K401. In order to transmit the control signals to the local control unit, relay K401 must be closed. This relay is energized whenever switch S410 is in the "SINGLE" position (used when only one remote station is connected and Junction Box J-476/CRD-6 is not employed) or, with switch S410 in the "PARALLEL" position, whenever the moving contact on the stepping relay K601 connects the relay K401 to the power supply contained in the junction box. Stepping relay K601 moves one switch position each time it is energized. When it has covered all four positions, it starts the cycle over again the next time switch S406 is depressed on any remote control unit. With switch S410 in the "PARALLEL" position the power supply in the junction box supplies all the "STATION" lights and the spiral-four control relay K401 in the remote control unit that has control of the system.

2-76. When K401 closes, current is sent through the matching transformers and the spiral-four cable to control relays K313, K314, K315, K317, and K318 in the local control unit. The currents supplied to these relays differ both in magnitude and polarity for every position of channel frequency switch S408 and target switch S407. Thus the switching relays, energized by selenium rectifier power supply CR301 contained in the local control unit, are placed in a definite set of conditions for each position of S407 and S408. Switching relays K301 through K310, K312, K316, and K319 thus tune the receiver and transmitter to the desired channel, light the proper channel indicator lights, and turn the transmitter on and off.

2-77. The values of current shown next to each of the control relays are nominal minimum operating currents. Control relays K313, K314, and K317 are polarized relays which close in one direction for positive currents and in the opposite direction for negative currents, as shown in figure 2-20.

2-78. Control relay K317 is energized whenever one of the buttons on S408 is pushed. The left hand contacts of K317 supply the energizing voltage to power control relay K311, which turns on the power for all the components mounted at the local position.

2-79. To make clear the operation of the remote control circuits, the following occurs when channel "7" button on S408 at remote station A is depressed: Stepping relay K601 is in position one, energizing K401 at remote stations A and thus permitting it to control the system. Now button number "7" on S408 is depressed. This taps the power supply in the remote control of R444 and R460, causing a current of approximately minus five milliamperes to flow into K317 and a current of approximately plus 12 milliamperes to flow into K315. Figure 2-21 shows the resulting state of the relays for these input currents.

NOTE

Only those relay contacts directly concerned with the channel are shown in figure 2-21.

2-80. LOCAL CONTROL UNIT POWER SUPPLY CIRCUIT. (See figure 2-22.)

2-81. Selenium rectifier CR301 is connected as a full-wave bridge. Its rectified output is not filtered, but is applied directly to coils of the appropriate switching relays. The manner in which these relays are selected is described in paragraphs 2-75 through 2-79.

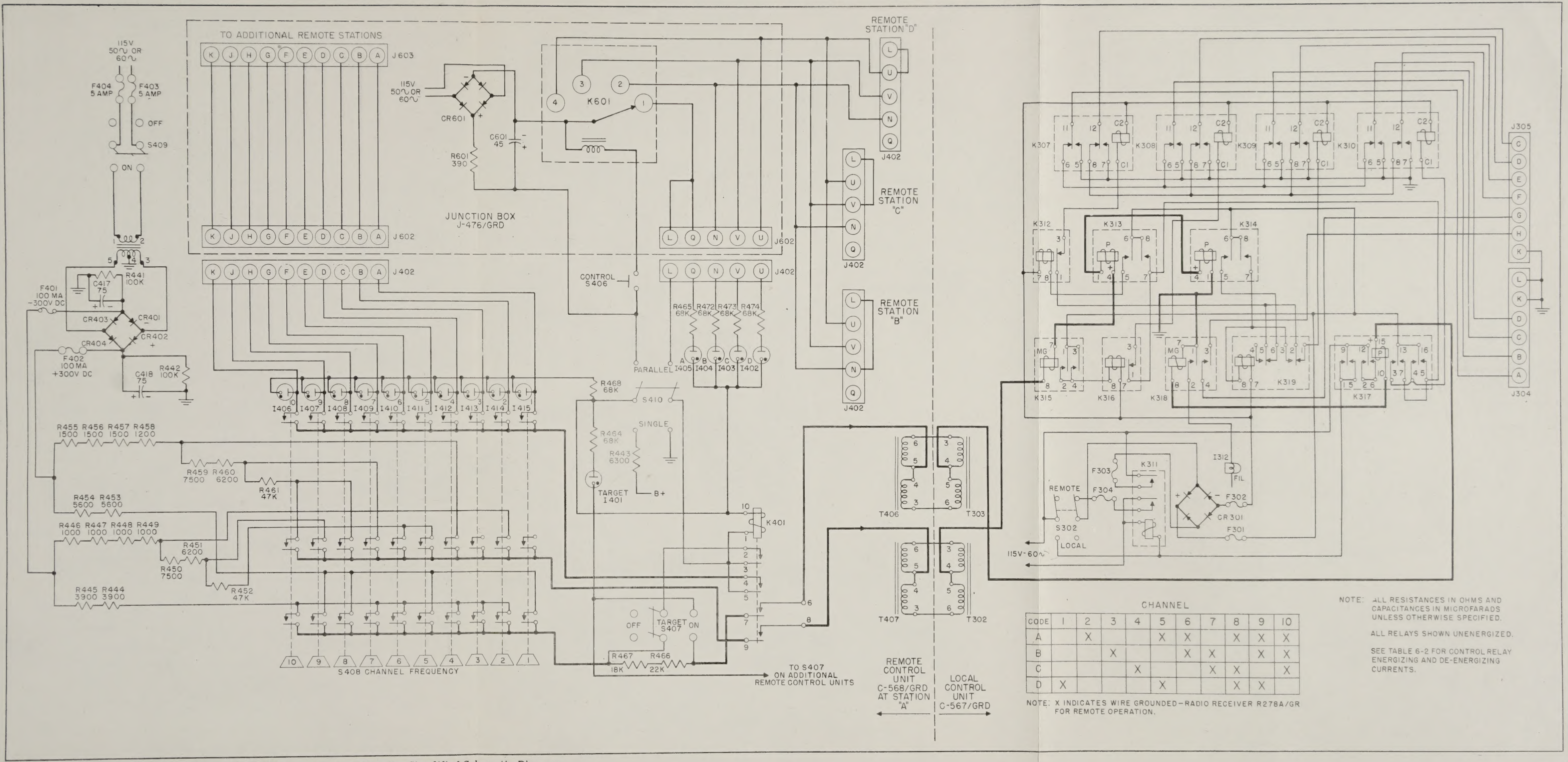
2-82. Tube V306 is a double diode connected as a full-wave rectifier whose rectified output is filtered by a two-section LC filter. The output of the first filter section is the B+ to the reference amplifier and that of the second filter section is the B+ to the DF amplifier.

2-83. OTHER REMOTE CONTROL UNIT CIRCUITS.

2-84. In addition to the control circuits discussed previously, Direction Finder Control C-568/GRD contains an audio amplifier and two reference amplifiers which supply the two-phase reference voltages to the phasemeter. (See figure 2-23.)

2-85. REMOTE CONTROL UNIT AUDIO AMPLIFIER CIRCUIT. (See figure 2-24.)

2-86. The DF signal from the local control unit is coupled to the audio amplifier and to the indicator by transformer T407. Potentiometer R462 varies the loading of the secondary of T407 and thus determines the magnitude of the DF voltage sent to the indicator and to the first stage of the audio amplifier.



CHANNEL

CODE	1	2	3	4	5	6	7	8	9	10
A		X			X	X		X	X	X
B			X			X	X		X	X
C				X			X	X		X
D	X				X			X	X	

NOTE: X INDICATES WIRE GROUNDED—RADIO RECEIVER R278A/GR FOR REMOTE OPERATION.

NOTE: ALL RESISTANCES IN OHMS AND CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

ALL RELAYS SHOWN UNENERGIZED.

SEE TABLE 6-2 FOR CONTROL RELAY ENERGIZING AND DE-ENERGIZING CURRENTS.

Figure 2-20. Radio Direction Finder AN/CRD-6 Remote Control Circuits, Simplified Schematic Diagram

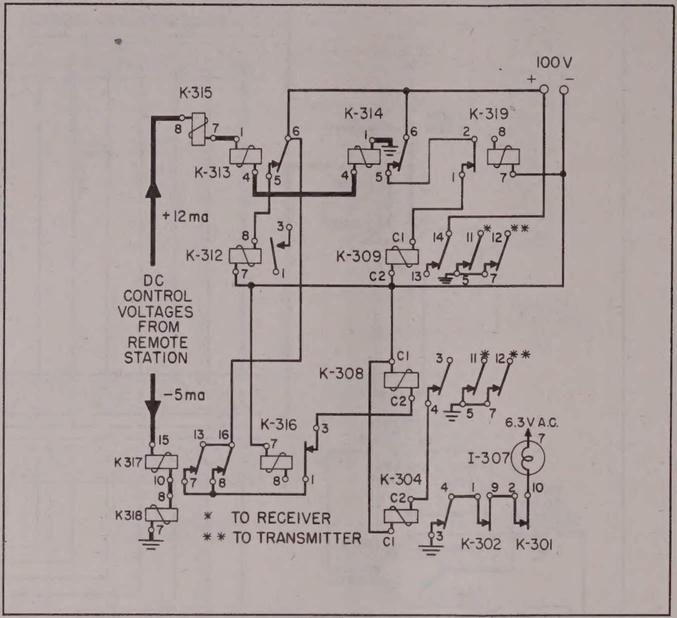
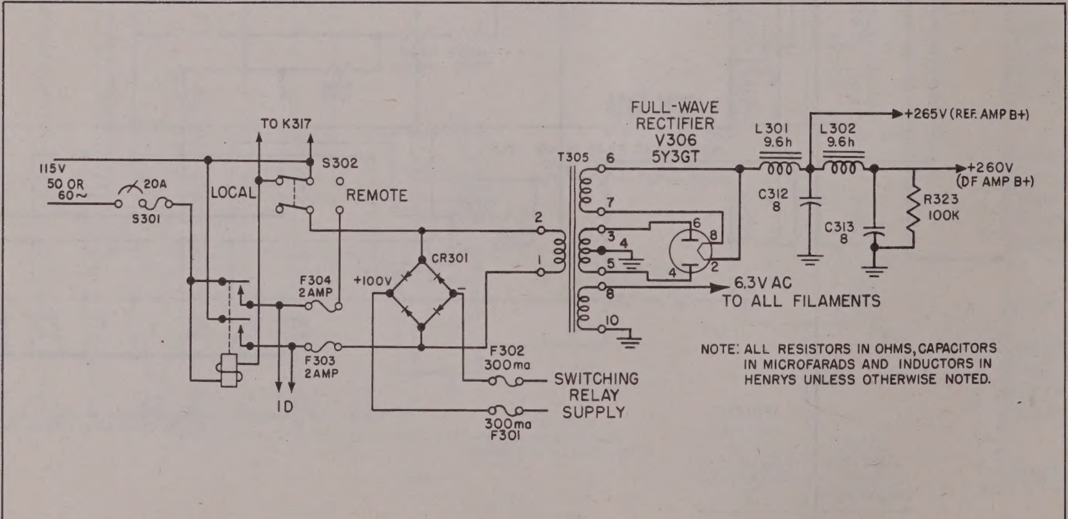


Figure 2-21. Condition of Local Control Unit Relays with Channel "7" Selected at Remote Control Unit



NOTE: ALL RESISTORS IN OHMS, CAPACITORS IN MICROFARADS AND INDUCTORS IN HENRYS UNLESS OTHERWISE NOTED.

Figure 2-22. Direction Finder Control C-567/GRD Power Supply, Simplified Schematic Diagram

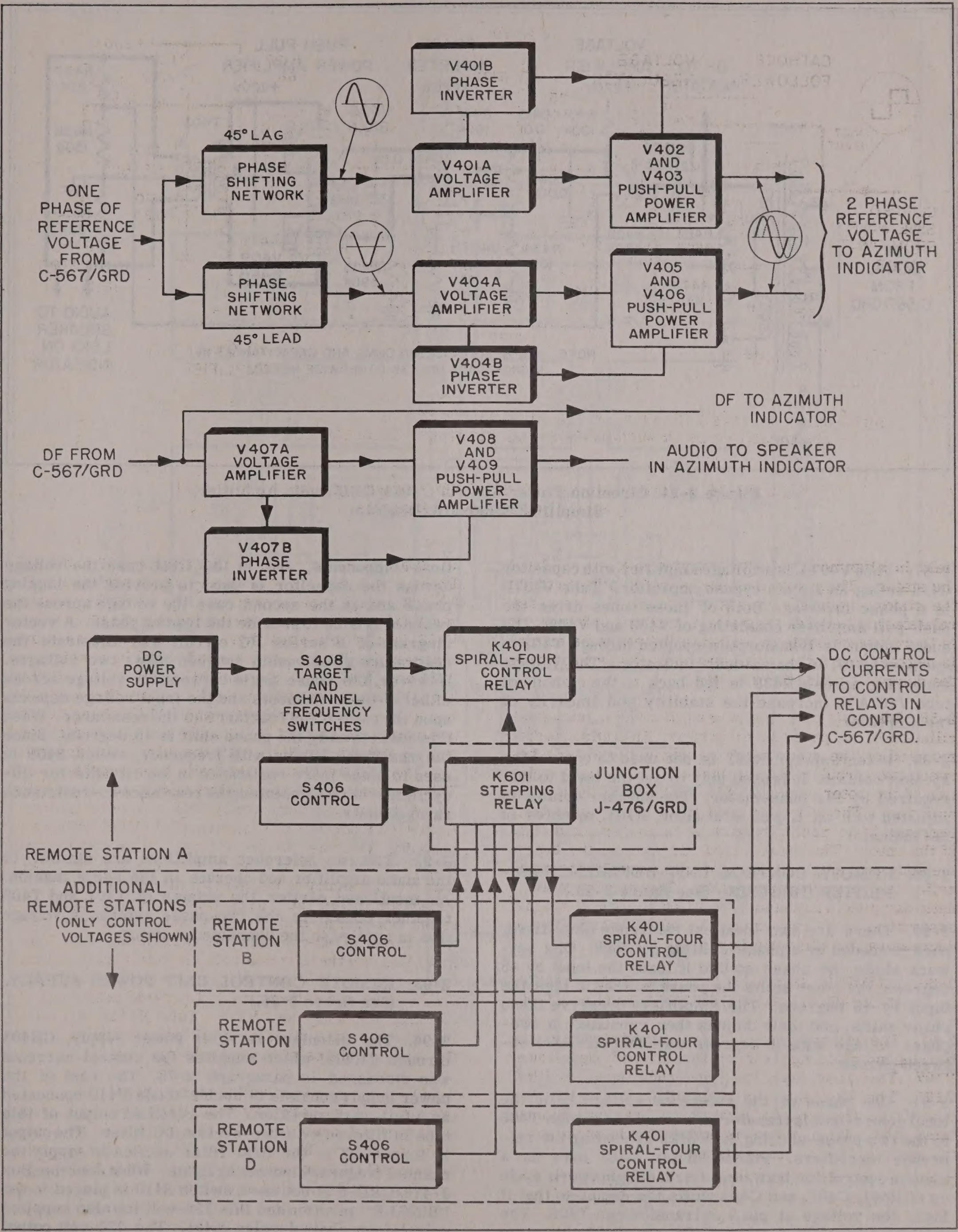


Figure 2-23. Direction Finder Control C-568/GRD, Simplified Block Diagram Showing Junction Box and Additional Remote Stations

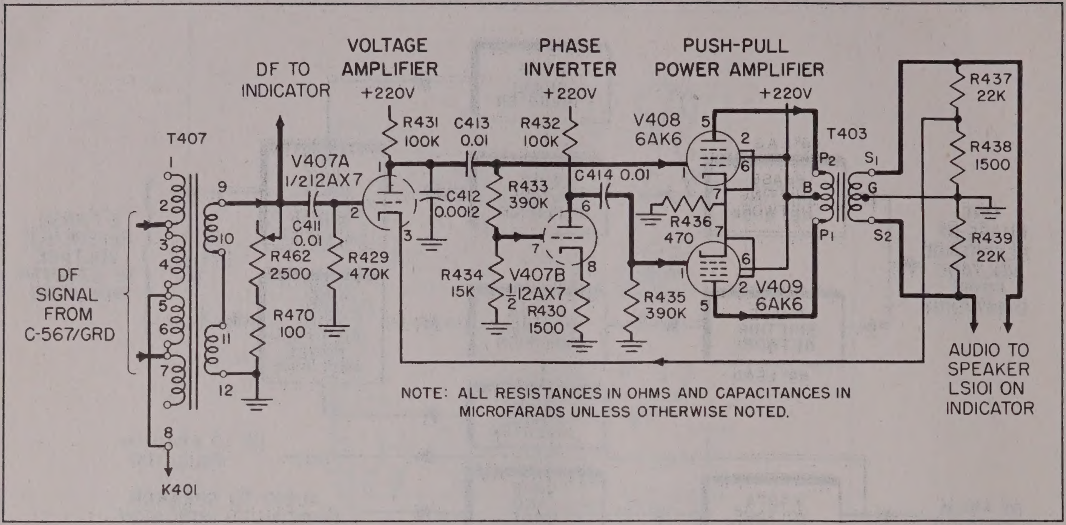


Figure 2-24. Direction Finder Control C-568/GRD Audio Amplifier, Simplified Schematic Diagram

2-87. Tube V407A is a voltage amplifier with capacitor C412 acting as a plate bypass capacitor. Tube V407B is a phase inverter. Both of these tubes drive the push-pull amplifier consisting of V408 and V409. The audio output is transformer-coupled through T403 to speaker LS101 in the azimuth indicator. The voltage appearing across R438 is fed back to the cathode of tube V407A to increase the stability and linearity of the amplifier.

2-88. Potentiometer R462 is not used to control the speaker volume. It is used only to set the level to that required by the phasemeter. The speaker volume is adjusted with an L-pad attenuator, R101, mounted in the indicator.

2-89. REMOTE CONTROL UNIT REFERENCE AMPLIFIER CIRCUITS. (See figure 2-25.)

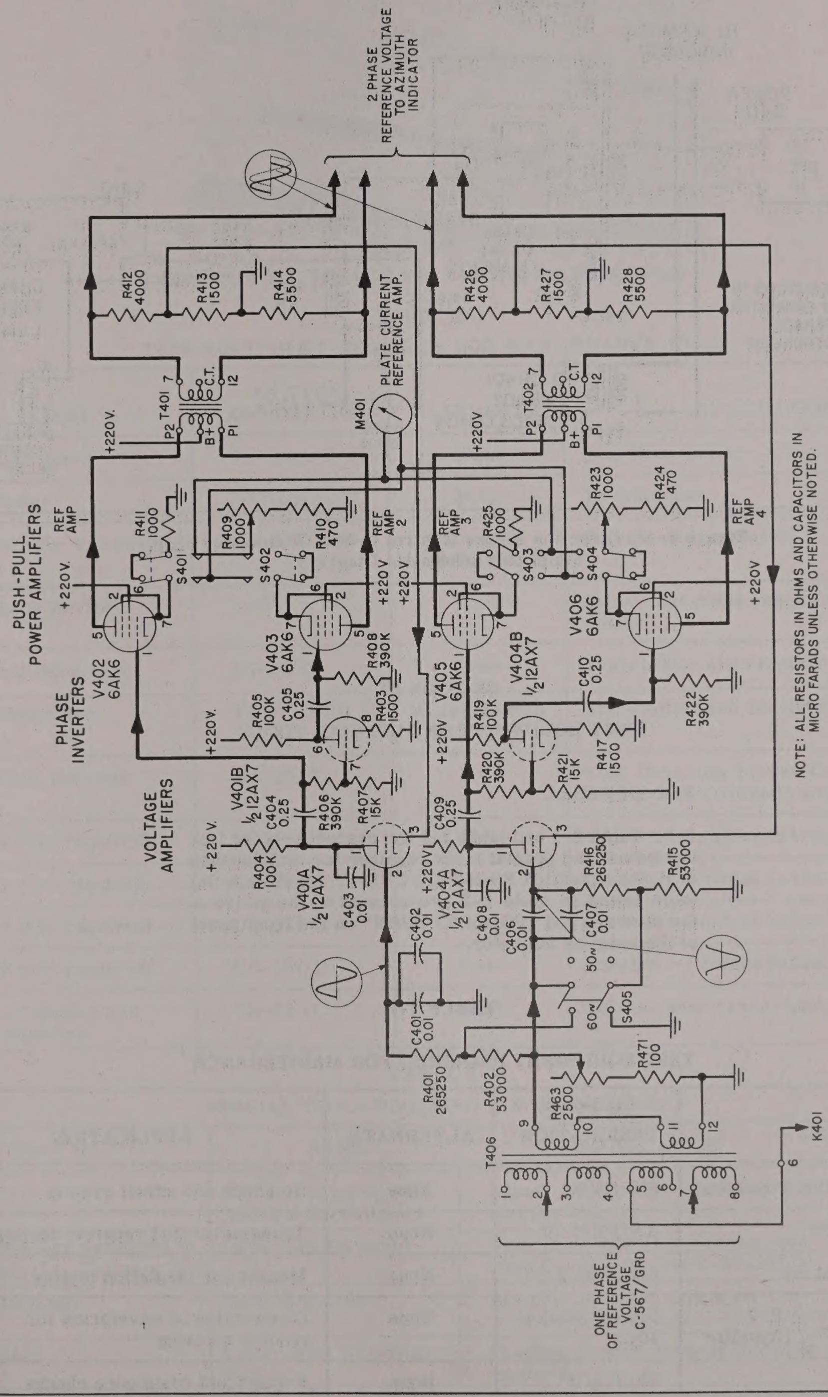
2-90. There are two identical reference amplifiers, each preceded by a phase-shifting network. One network shifts the phase so that it leads the input by 45 degrees; the other shifts the phase so that it lags the input by 45 degrees. The amplifiers preserve these phase shifts, and their outputs then constitute a two-phase voltage with 90 degrees time displacement between phases.

2-91. One phase of the reference voltage from the local control unit is transformer-coupled through T406 to the two phase-shifting networks preceding the reference amplifiers. Potentiometer R463 acts as a volume control for both amplifiers. The network made up of R401, C401, and C402 shifts the signal so that it lags the voltage at pin 9 of transformer T406. The network composed of R416, C406, and C407 shifts the signal so that it leads the voltage at pin 9 of transformer T406 by 45 degrees. Both networks have identical components, but in the first case the voltage across the capacitor is used to provide the lagging phase and in the second case the voltage across the resistor is used to provide the leading phase. A vector diagram of a series RC circuit will illustrate the quadrature relationship between these two voltages. However, the phase angle between the voltage across either of these elements and the input voltage depends upon the ratio of the reactance to the resistance. When this ratio is unity the phase shift is 45 degrees. Since the reactance varies with frequency, switch S405 is used to place more resistance in the circuits for 50-cycle operation to maintain the reactance-to-resistance ratio of unity.

2-92. The two reference amplifiers are similar to the audio amplifier and operate in the same fashion. As mentioned earlier, the outputs of T401 and T402 together constitute the two-phase reference voltage that is applied to the phasemeter stator.

2-93. REMOTE CONTROL UNIT POWER SUPPLY. (See figure 2-26.)

2-94. The selenium rectifier power supply, CR401 through CR402, which supplies the control currents was discussed in paragraph 2-75. The rest of the power supply consists of double-diode V410 connected as a full-wave rectifier. The rectified output of this tube is filtered by a two-section LC filter. The output is tapped off at the first filter section to supply the channel frequency indicating lights. When Junction Box J-476/CRD-6 is not used, switch S410 is placed in the "SINGLE" position and this 235-volt tap also supplies spiral-four control relay K401. The 220-volt output available at the second filter section is the B+ supply for all the tubes in the remote control unit.



NOTE: ALL RESISTORS IN OHMS AND CAPACITORS IN MICRO FARADS UNLESS OTHERWISE NOTED.

Figure 2-25. Direction Finder Control C-568/GRD Reference Amplifier, Simplified Schematic Diagram

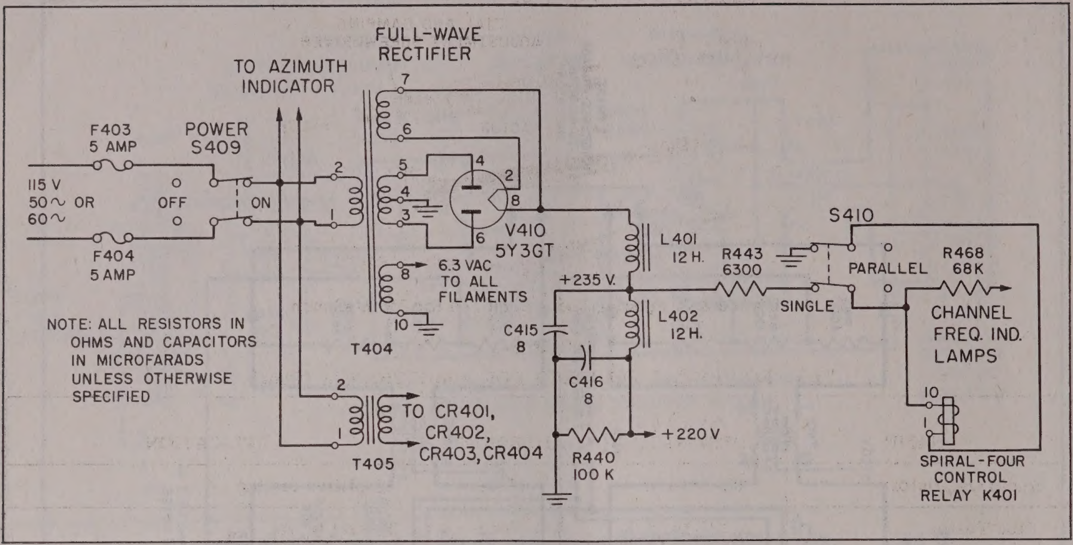


Figure 2-26. Direction Finder Control C-568/GRD Power Supply, Simplified Schematic Diagram

SECTION III

TEST EQUIPMENT AND SPECIAL TOOLS

3-1. GENERAL.

3-2. Table 3-1 and table 3-2 list respectively the test equipment and special tools required for maintenance of Radio Direction Finder AN/CRD-6. All the special tools listed in table 3-2 are located on the inside of the door marked "PULL TO OPEN" on the front panel of the azimuth indicator.

TABLE 3-1

TEST EQUIPMENT REQUIRED FOR MAINTENANCE

NAME	AN TYPE DESIGNATION	ALTERNATE	APPLICATION
Antenna Position Simulator	SM-26/U	None	To check and adjust system
Test Oscillator	AN/PRM-10	None	Transmitter and receiver testing
Insulation Test Set	AN/PSM-2	None	Megger for insulation testing
Oscilloscope with P-7 screen and 16-uf capacitor	Dumont Model 304H	None	Observation of waveforms for trouble shooting
Multimeter	TS-352/U	None	Voltage and resistance checks

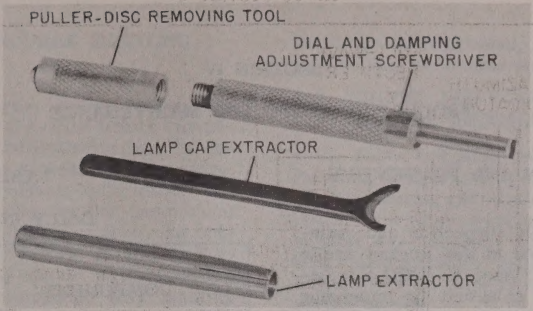

PULLER-DISC REMOVING TOOL
DIAL AND DAMPING ADJUSTMENT SCREWDRIVER
LAMP CAP EXTRACTOR
LAMP EXTRACTOR

Figure 3-1. Special Tools Required for Maintenance

TABLE 3-1

TEST EQUIPMENT REQUIRED FOR MAINTENANCE (Cont)

NAME	AN TYPE DESIGNATION	ALTERNATE	APPLICATION
Audio Oscillator	TS-382A/U	None	Amplifier testing
Tube Tester	I-177(D)	None	To test tubes
Vacuum-Tube Voltmeter	ME-6/U	Ballantine Model 300	Voltage measurements
Wheatstone Bridge	I-49	None	Spiral-four cable resistance measurements
RF Signal Generator	SG-24/U	None	Transmitter and receiver testing
Signal Generator	TS-497/URR	Measurements Model 80	Transmitter and receiver testing
Phase Shift Indicator	ME-63/U	None	Test Direction Finder Control C-568/GRD reference amplifiers
Adapter (two required)	UG-201/U	None	Connect r-f cables to test instruments
Adapter (two required)	UG-255/U	None	Connect r-f cables to test instruments
Adapter (two required)	UG-274/U	None	Connect r-f cables to test instruments
Adapter (two required)	UG-107/U	None	Connect r-f cables to test instruments
Six-db attenuator pad (three required)	CN-32/U	None	Antenna preference check

TABLE 3-2

SPECIAL TOOLS REQUIRED FOR MAINTENANCE

PART NO.	NAME	APPLICATION	FIGURE NO.
NL-70011-1	Dial and Damping Adjustment Screwdriver	Adjust phasemeter damping and dial position	3-1
No. 24 (Kellogg Switchboard and Supply Co., Chicago, Ill.)	Lamp Cap Extractor	Remove indicator lamp caps on controls C-567/GRD and C-568/GRD	3-1
No. 25 (Kellogg)	Lamp Extractor	Remove indicator lamps on controls C-567/GRD and C-568/GRD	3-1
NL-69854-1	Puller-Disc Removing Tool	Position pointer between damping magnets	3-1

SECTION IV

TROUBLE SHOOTING AND MAINTENANCE

4-1. PERIODIC INSPECTION AND PREVENTIVE MAINTENANCE.

4-2. GENERAL. The periodic inspection and maintenance instructions contained in this section are to assure that Radio Direction Finder AN/CRD-6 is being maintained and is free of actual or impending troubles. Inspection is the most important operation in preventive maintenance. Although minor defects may not at the moment interfere with performance, time and effort can be saved if such defects are corrected before they lead to costly major breakdowns.

NOTE

When meter readings are required in an inspection, be sure to allow the equipment to reach normal operating temperature before taking a reading.

4-3. DAILY INSPECTION.

4-4. Daily inspections other than those listed in table 4-1 are covered in "Operation and Service Instructions, Radio Direction Finder AN/CRD-6."

TABLE 4-1

DAILY INSPECTION

COMPONENT	INSPECTION OR CHECK
Radio Receiver R-278A/GR	*Check tuning. Align if necessary.
Radio Transmitter T-216/GR	*Check tuning. Align if necessary.

*Perform in accordance with instructions in applicable handbook.

4-5. MONTHLY INSPECTION.

4-6. Table 4-2 lists the checks and maintenance required for monthly inspection of Radio Direction Finder AN/CRD-6.

TABLE 4-2

MONTHLY INSPECTION

COMPONENT	INSPECTION OR CHECK
Antenna AS-449/GRD	1. Perform tests prescribed in paragraphs 5-4 through 5-9.
Comparator CM-23/GR	1. Inspect all components on chassis for signs of overheating, leaking capacitors or transformers, loose or broken connections, and dirt or corrosion. Correct as required. 2. Perform tests prescribed in paragraphs 5-10 through 5-21. 3. Inspect and clean relays as outlined in paragraph 4-15.
Direction Finder Controls C-567/GRD and C-568/GRD	1. Inspect all components on chassis for signs of overheating, leaking capacitors or transformers, loose or broken connections, and dirt and corrosion. Correct as required. 2. Perform tests prescribed in paragraphs 5-22 through 5-32. 3. Inspect and clean relays as outlined in paragraph 4-15.
Azimuth Indicator ID-260/GRD	1. Inspect all components on chassis for signs of overheating, leaking capacitors or transformers, loose or broken connections, and dirt and corrosion. Correct as required. 2. Perform tests prescribed in paragraphs 5-33 through 5-43.
Junction Box J-476/CRD-6	1. Inspect all components for signs of overheating, leaking capacitors, loose or broken connections, dirt and corrosion. 2. Inspect and clean relay contacts of K601 as outlined in paragraph 4-15.
Radio Direction Finder AN/CRD-6	1. Perform tests prescribed in paragraphs 5-44 through 5-50.

4-7. GENERAL SYSTEM TROUBLE SHOOTING.

4-8. When some fault in operation is observed, the defective component must first be located before any repair can be attempted. To facilitate locating the defective component, follow a systematic procedure, checking back from the observed fault to the input. The defective component will be the one that has normal input applied to it but which provides an abnormal output. Refer to the applicable portion of section V to determine the conditions that should be found at the input and the output of each component. After locating the defective component, refer to table 4-3 for detailed instructions on trouble shooting the component.

4-9. CIRCUIT AND COMPONENT TROUBLE SHOOTING.

4-10. Table 4-3 lists the trouble shooting procedure for each component, by component, and serves as a guide in locating and repairing troubles in the system. Unless otherwise specified, the "SYMPTOM" column in table 4-3 assumes that all other components are functioning normally. Before deciding that a component is defective, be sure to check all fuses and interconnecting cables.

TABLE 4-3

CIRCUIT AND COMPONENT TROUBLE SHOOTING

AZIMUTH INDICATOR ID-260/GRD		
SYMPTOM	**PROBABLE CAUSE**	**REMEDY**
Phasemeter inoperative or very sluggish. Bearing indicator lamp I101 (above phasemeter) lights. Cathode ray tube V111 (figure 4-1) provides proper display	1. Damping disc O-107 (figure 4-10) in contact with magnet assembly	1. Adjust position of damping disc as outlined in paragraph 4-20.
	2. No DF voltage to phasemeter rotor. (Check at TP112, figure 4-2.)	2. Check V103 (figure 4-1), V104, V105, and associated circuits. Replace defective components.
	3. P101 not plugged into J104	3. Plug in P101.
	4. Either or both phases of reference voltage not present in indicator. (Check at TP101 and TP102 on rear of indicator)	4. Check cables and connections. Check continuity for reference voltages through Comparator CM-23/GR to Antennas AS-449/GRD alternators. Replace defective components.
	5. Defective phasemeter (open rotor or stators)	5. Replace phasemeter.
Bearing indicator lamp I101 (above phasemeter) does not light. Phasemeter and oscilloscope normal	1. V108 (figure 4-2) or I101, or associated circuits, defective	1. Check, and replace defective components.
No spot on cathode ray tube V111 (figure 4-1)	1. No B+ to oscilloscope circuits	1. Check power supply and B+ connections. Replace defective components.
	2. V111 defective	2. Replace V111.
	3. No filament voltage	3. Check filament supply. Repair or replace defective parts.
Horizontal sweep cannot be obtained on cathode ray tube V111 (figure 4-1)	1. Sweep generator or sweep amplifier or associated circuits defective	1. Check V112 (figure 4-1) and V113 and associated circuits. Repair or replace defective components.
Only horizontal line displayed on cathode ray tube V111 (figure 4-1)	1. Vertical amplifier V112 (figure 4-1) or associated circuit faulty	1. Repair or replace defective components.

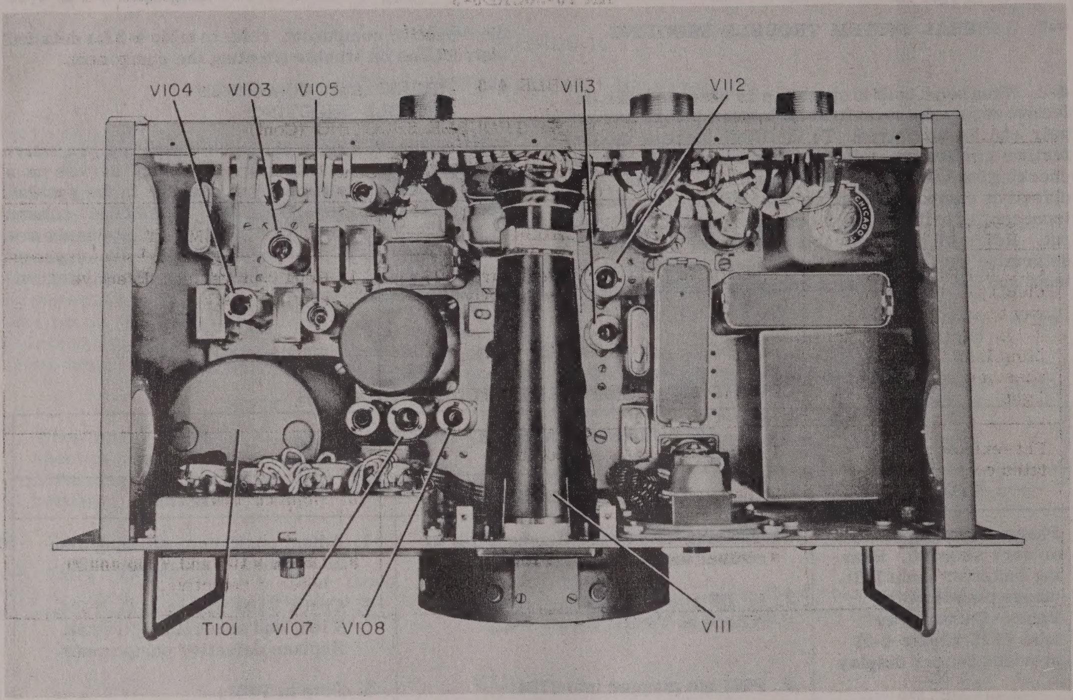


Figure 4-1. Azimuth Indicator ID-260/GRD - Top View with Cover Off

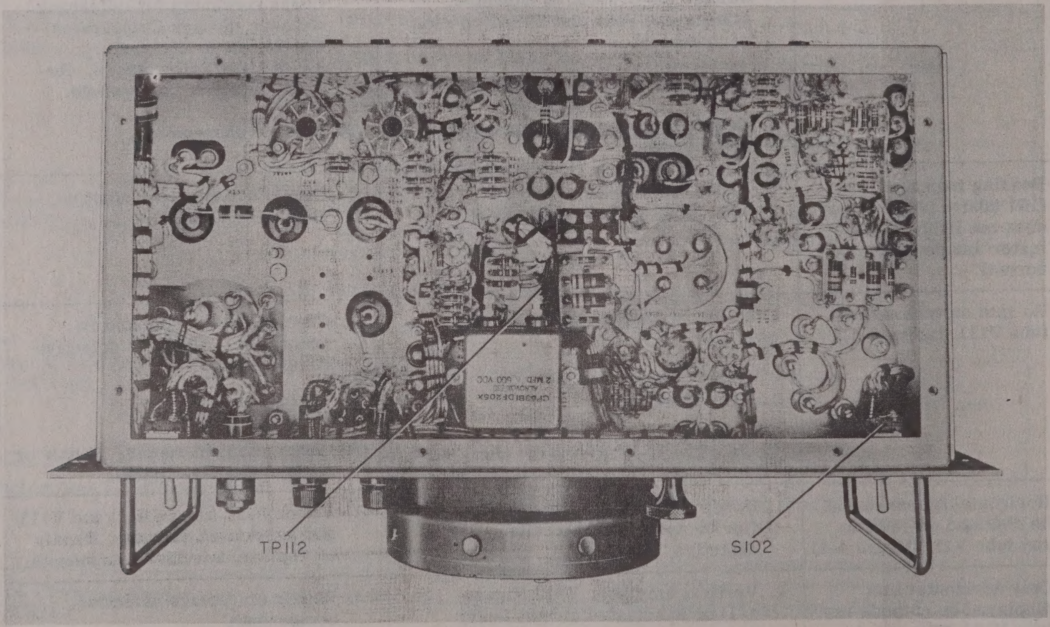


Figure 4-2. Azimuth Indicator ID-260/GRD - Bottom View with Cover Off

TABLE 4-3
CIRCUIT AND COMPONENT TROUBLE SHOOTING (Cont)

AZIMUTH INDICATOR ID-260/GRD (Cont)

SYMPTOM	PROBABLE CAUSE	REMEDY
Only horizontal line displayed on cathode ray tube V111 (figure 4-1). Bearing indicator lamp I101 (above phasemeter) does not light	1. Cathode follower V107 (figure 4-1) or associated circuits defective	1. Repair or replace defective components.
Phasemeter pointer rotates continuously	1. Phasemeter rotor shorted 2. Shorted winding on T101 (figure 4-1) 3. V104 (figure 4-1) or V105 defective	1. Replace phasemeter. 2. Replace T101. 3. Check V104 and V105 and replace if defective.

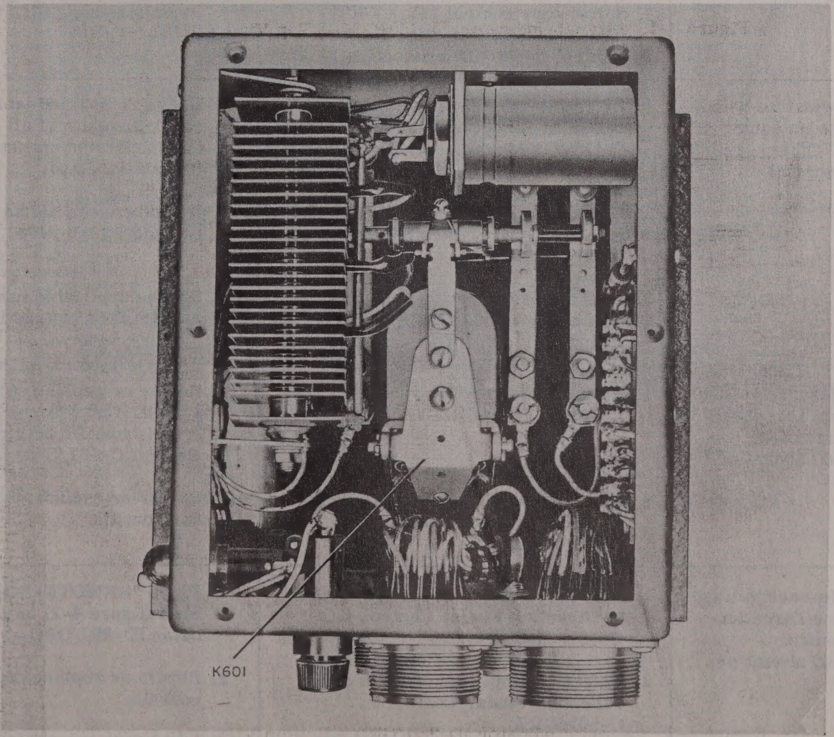


Figure 4-3. Junction Box J-476/CRD-6 - Top View with Cover Off

TABLE 4-3

CIRCUIT AND COMPONENT TROUBLE SHOOTING (Cont)

DIRECTION FINDER CONTROLS C-567/GRD AND C-568/GRD		
SYMPTOM	PROBABLE CAUSE	REMEDY
Station cannot take control of system	1. Power supply in Junction Box J-476/CRD-6 faulty	1. Repair or replace faulty components.
	2. Stepping relay K601 (figure 4-3) in junction box defective	2. Replace K601.
Channel selection does not operate	1. Selenium rectifier power supply or associated circuits in Direction Finder Control C-568/GRD defective	1. If necessary, replace CR401 (figure 4-4) through CR404. Check associated circuits and replace faulty components.
	2. Selenium rectifier power supply or associated circuits in Direction Finder Control C-567/GRD defective	2. Replace CR301 (figure 4-5). Check associated circuits and repair or replace faulty components.
	3. No control current input to Direction Finder Control C-567/GRD	3. Repair or replace spiral-four cable. Replace transformer T302 (figure 4-5), T303, T406 (figure 4-4) or T407.
	4. Spiral-four control relay K401 (figure 4-4) in Direction Finder Control C-568/GRD defective	4. Replace relay K401.
Channel selection does not operate on some channels. Other channels normal	1. Defective control or switching relays in Direction Finder Control C-567/GRD	1. Use table 6-1 and table 6-2 to check the state of all relays for the unoperated channels. Replace the faulty relays.
	2. Bad contacts on "CHANNEL FREQUENCY" switch S408 (figure 4-6)	2. If contacts can not be repaired replace switch S408.
	3. Radio Transmitter T-216/GR or Radio Receiver R-278A/GR defective	3. See the applicable handbook for maintenance instructions.
DF or reference voltage output from Direction Finder Control C-568/GRD absent or incorrect	1. No input to Direction Finder Control C-568/GRD	1. Repair or replace spiral-four cables. Check for presence of output from Direction Finder Control C-567/GRD.
	2. Defective amplifier circuits in Direction Finder Control C-567/GRD	2. Repair or replace defective components.
DF or reference voltage output from Direction Finder Control C-567/GRD absent or incorrect	1. No DF or reference voltage input to Direction Finder Control C-567/GRD	1. Place "REMOTE-LOCAL" switch S102 (figure 4-2) on Azimuth Indicator ID-260/GRD at "REMOTE."
	2. Defective amplifier circuits in Direction Finder Control C-567/GRD	2. Repair or replace defective components.

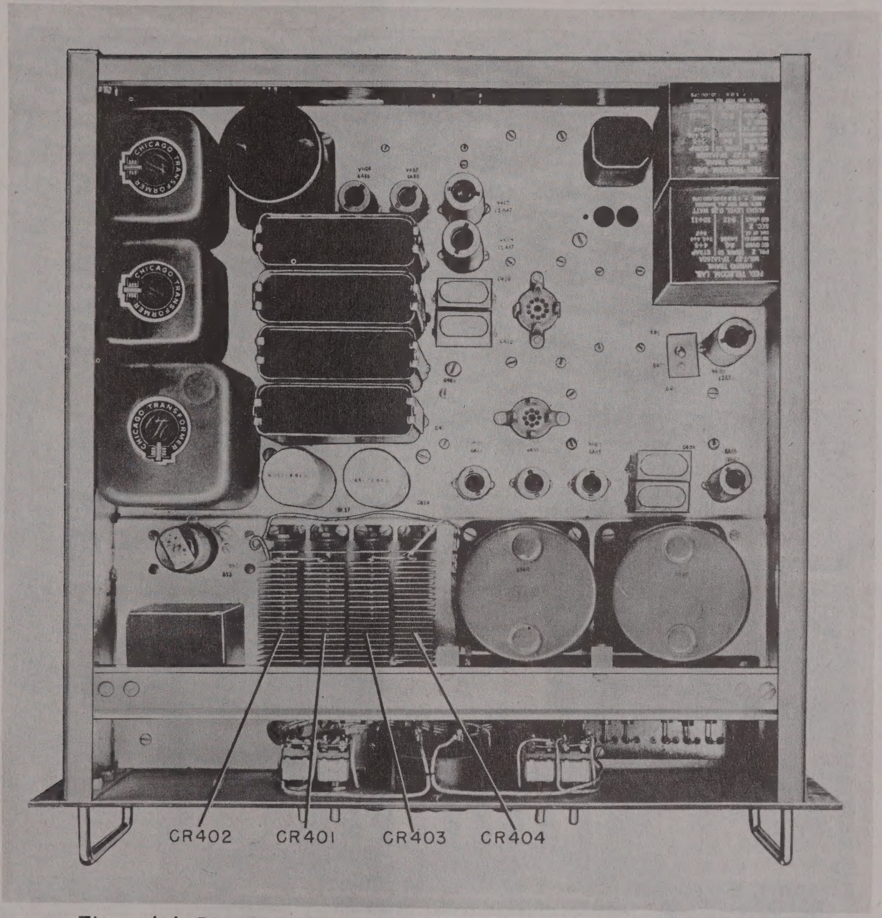


Figure 4-4. Direction Finder Control C-568/GRD - Top View with Cover Off

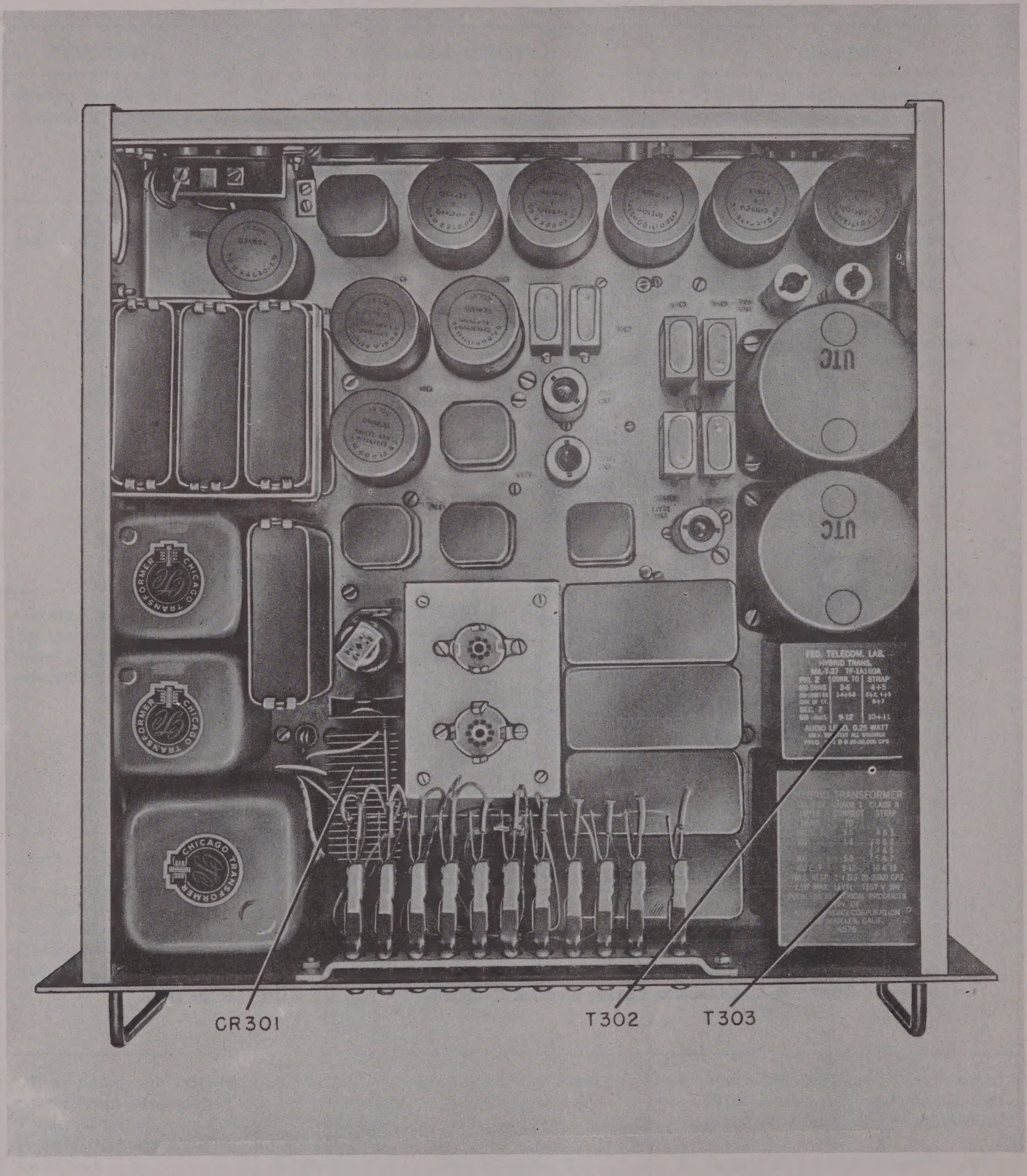


Figure 4-5. Direction Finder Control C-567/GRD - Top View with Cover Off

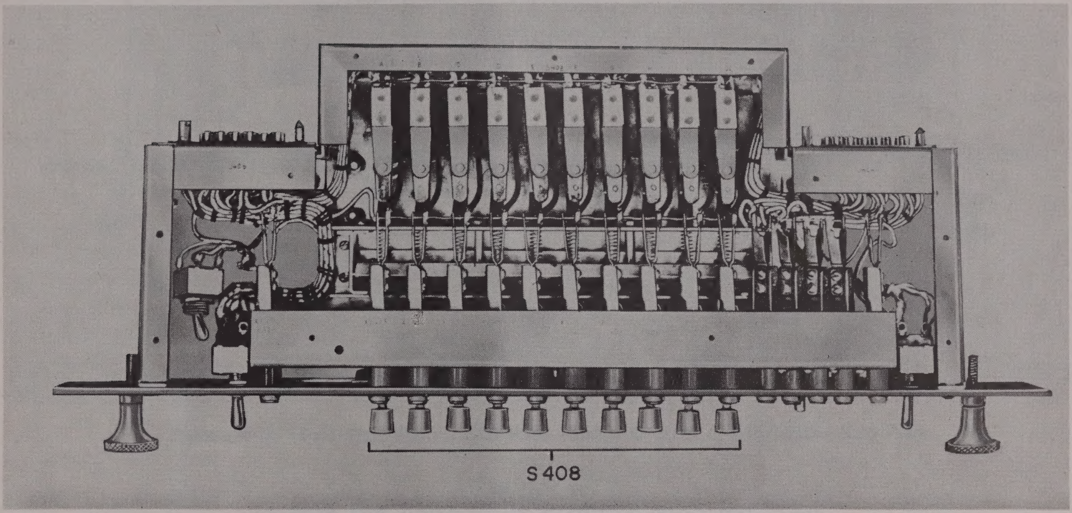


Figure 4-5A. Pull-Out Panel, Direction Finder Control C-568/GRD - Top View, as manufactured under Air Force Contract No. AF33(038)-30605

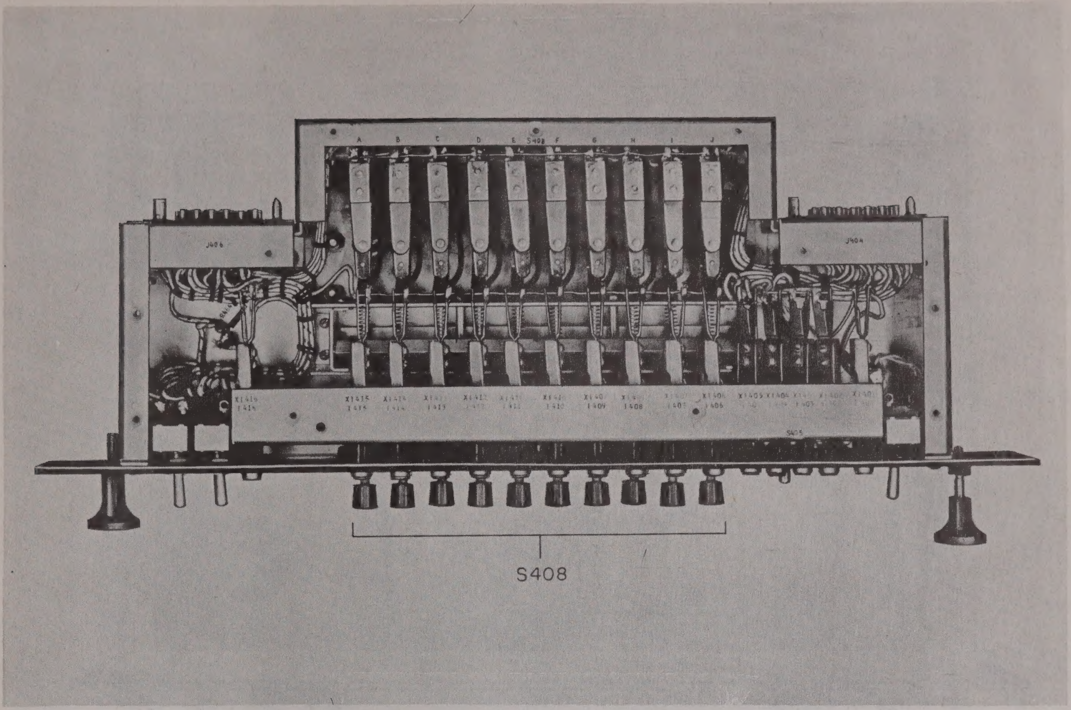


Figure 4-6. "Pull-Out" Panel, Direction Finder Control C-568/GRD - Top View

TABLE 4-3

CIRCUIT AND COMPONENT TROUBLE SHOOTING (Cont)

COMPARATOR CM-23/GR		
SYMPTOM	PROBABLE CAUSE	REMEDY
DF output absent or incorrect with antenna selector switch S503 (figure 4-7) at either "ANTENNA NO. 1" or "ANTENNA NO. 2."	1. No DF output from Radio Receiver R-278A/GR	1. Trouble shoot receiver in accordance with applicable handbook.
	2. No RF input to receiver	2. a. Repair or replace antenna relays K502 (figure 4-6) and K503. b. Repair or replace r-f cable CG-967/U
	3. Defective disabling relay K504 (figure 4-8)	3. Replace relay K504.
Reference voltage output absent or incorrect	1. Motor or generator in Antenna AS-449/GRD defective	1. Replace defective component.
	2. Defective stator switching relay K505 (figure 4-8)	2. Replace relay K505.
	3. Defective channel selection relay K501 (figure 4-8)	3. Replace relay K501.
	4. Comparison tube V505 (figure 4-8) or associated circuits defective	4. Repair or replace defective components.

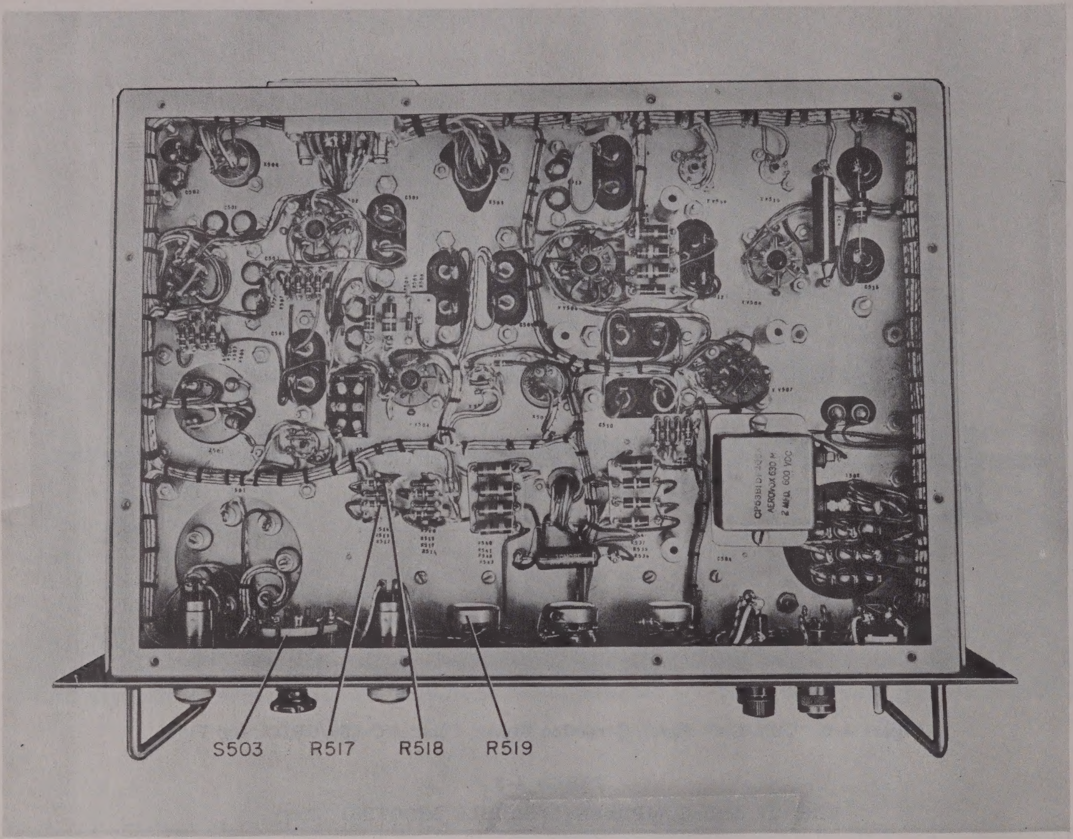


Figure 4-7. Comparator CM-23/GR - Bottom View with Cover Off

TABLE 4-3

CIRCUIT AND COMPONENT TROUBLE SHOOTING (Cont)

COMPARATOR CM-23/GR (Cont)		
SYMPTOM	**PROBABLE CAUSE**	**REMEDY**
No cycling on automatic operation	1. No B+	1. Check comparator power supply and associated circuits. Repair or replace defective components.
	2. Relay driver V507 (figure 4-8) or associated circuits defective	2. Repair or replace defective components.
	3. Defective timing multivibrator V506 (figure 4-8)	3. Replace V506.
	4. Defective antenna selector switch S503 (figure 4-7)	4. Replace S503.
	5. P501 not plugged into J501 (figure 4-8)	5. Plug in P501.

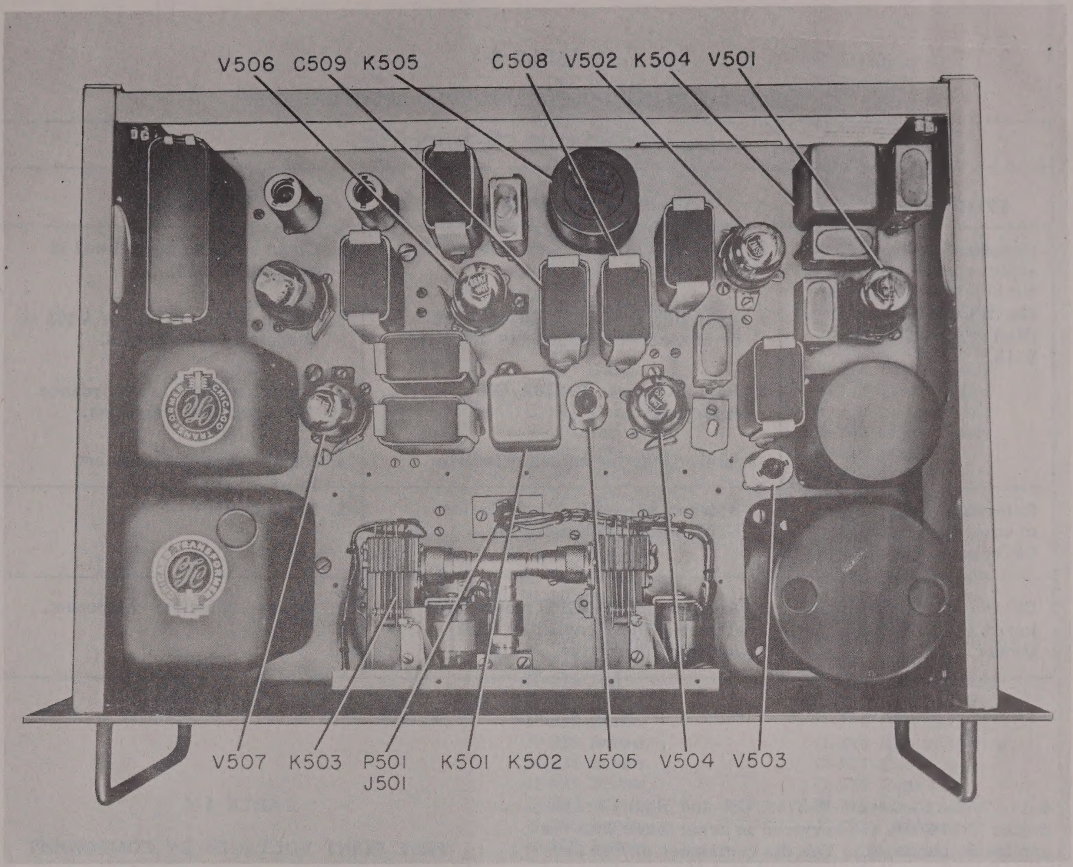


Figure 4-8. Comparator CM-23/GR - Top View with Cover Off

TABLE 4-3

CIRCUIT AND COMPONENT TROUBLE SHOOTING (Cont)

COMPARATOR CM-23/GR (Cont)		
SYMPTOM	PROBABLE CAUSE	REMEDY
"ANTENNA PREFERENCE" Control R519 (figure 4-8) cannot be set properly (Refer to paragraph 5-18, steps o and p.)	1. V504 (figure 4-8) or V505 and associated circuit defective	1. Repair or replace defective components.
	2. Comparison relay K501 (figure 4-8) defective	2. Replace K501.
	3. Auxiliary contacts on K502 (figure 4-8) defective	3. Clean and readjust contacts as outlined in paragraph 4-15.
	4. Storage circuits consisting of C508 (figure 4-8), C509, R517 (figure 4-7), and R518	4. Replace defective components.

TABLE 4-3

CIRCUIT AND COMPONENT TROUBLE SHOOTING (Cont)

COMPARATOR CM-23/GR (Cont)		
SYMPTOM	PROBABLE CAUSE	REMEDY
Comparator does not select correct antenna but antenna preference check is satisfactory (Refer to paragraph 5-18.)	1. R-f contacts on antenna relays defective	1. Clean contacts as outlined in paragraph 4-15.
	2. V501 (figure 4-8), V502, or V503 or associated components defective	2. Replace V501, V502, or V503 or associated components.
	3. Radio Receiver R-278A/GR defective	3. Check receiver in accordance with applicable handbook.
	4. Interconnecting cables defective	4. Repair or replace cables.
Reference voltage input to comparator absent. DF voltage input present	1. Antenna AS-449/GRD generator G201 (figure 4-9) defective	1. Replace G201.
DF and reference voltage inputs to comparator absent	1. Antenna AS-449/GRD motor B201 (figure 4-9) or capacitor C201 (or C202) defective	1. Replace defective component.

4-11. Radio Receiver R-278A/GR and Radio Transmitter T-216/GR are serviced in accordance with the applicable handbooks. For the remainder of this section, therefore, it is assumed that the receiver and transmitter are functioning normally.

4-12. The test points located on the various components serve to facilitate localizing troubles. Table 4-4 lists the voltages normally found at the various test points. Section VI contains terminal voltage and resistance diagrams as well as schematic and practical wiring diagrams. Table 6-1, "State of Relays for Various Control Positions," and table 6-2, "Current Required to Operate and Release Control Relays of Direction Finder Control C-567/GRD," are also included in Section VI. During trouble shooting, refer to section VI constantly. After a trouble has been located and remedied, check for normal operation by performing the applicable tests prescribed in section V.

4-13. REPAIR OF ELECTRONIC COMPONENTS.

4-14. GENERAL. With the exception of those relays that are not hermetically sealed, the electronic component parts of Radio Direction Finder AN/CRD-6 cannot be repaired or serviced. When such a part is found defective, it must be replaced.

TABLE 4-4

TEST POINT VOLTAGES BY COMPONENT

AZIMUTH INDICATOR ID-260/GRD			
Test Point	Voltage	Test Point	Voltage
TP101	*	TP107	260Vdc
TP102	*	TP108	*
TP103	*	TP109	*
TP104	*	TP110	*
TP105	ground	TP111	*
TP106 A and B	*	TP112	*
DIRECTION FINDER CONTROL C-567/GRD			
TP301	1 Vrms	TP304	4.5 Vrms
TP302	ground	TP305	**22.5 Vrms
TP303	5 Vrms	TP306	265 Vdc
† DIRECTION FINDER CONTROL C-568/GRD			
TP401	220 Vdc	TP405	††10 Vrms
TP402	6 Vrms	TP406	ground
TP403	††1 Vrms	TP407	10 Vrms
TP404	13 Vrms	TP408	300 Vdc

A-201	Motor cover
A-202	Support
A-204	Tube support
A-205	Cover
A-206	Antenna base
A-207	Antenna cover
A-208	Gear housing
A-210	Gear support
A-211	Bearing support
A-213	Hood
A-215	Bracket
A-216	Block
A-217	Dipole support
B-201	Motor
C-201 or C-202	Capacitor
C-203	Capacitor
E-201	Insulator
E-202	Insulator
E-203	Reflector
E-206	Insulator
E-209	Insulator
E-210	Dipole
E-211	Dipole
G-201	Generator
H-201	Stud
H-205	Washer
H-208	Clamp
H-211	Clamp
H-212	Nut
H-216	Screw
H-218	Screw
H-220	Screw
H-221	Screw
H-223	Screw
H-224	Screw
H-225	Screw
H-226	Screw
H-227	Screw
H-228	Screw
H-229	Screw
H-230	Screw
H-233	Screw
H-234	Screw
H-235	Screw
H-237	Screw
H-238	Screw
H-240	Lock washer
H-241	Washer
H-242	Lock washer
H-243	Lock washer
H-244	Lock washer
H-245	Lock washer
H-246	Lock washer
H-247	Lock washer
H-248	Lock washer
H-249	Cable clamp
H-250	Stud
H-251	Clamp
H-252	Nut
H-253	Taper pin
H-254	Taper pin
J-201	Receptacle
J-202	Receptacle
J-203	Receptacle
O-202	Seal
O-203	Spring retainer
O-204	Spring
O-206	Ball bearing
O-207	Ball bearing
O-208	Ball bearing
O-210	Retaining ring
O-211	Coupling
O-216	Gear hub
O-219	Spur gear
S-201	Thermostat

TABLE 4-3

CIRCUIT AND COMPONENT TROUBLE SHOOTING (Cont)

COMPARATOR CM-23/GR (Cont)		
SYMPTOM	PROBABLE CAUSE	REMEDY
Comparator does not select correct antenna but antenna preference check is satisfactory (Refer to paragraph 5-18.)	1. R-f contacts on antenna relays defective	1. Clean contacts as outlined in paragraph 4-15.
	2. V501 (figure 4-8), V502, or V503 or associated components defective	2. Replace V501, V502, or V503 or associated components.
	3. Radio Receiver R-278A/GR defective	3. Check receiver in accordance with applicable handbook.
	4. Interconnecting cables defective	4. Repair or replace cables.
Reference voltage input to comparator absent. DF voltage input present	1. Antenna AS-449/GRD generator G201 (figure 4-9) defective	1. Replace G201.
DF and reference voltage inputs to comparator absent	1. Antenna AS-449/GRD motor B201 (figure 4-9) or capacitor C201 (or C202) defective	1. Replace defective component.

4-11. Radio Receiver R-278A/GR and Radio Transmitter T-216/GR are serviced in accordance with the applicable handbooks. For the remainder of this section, therefore, it is assumed that the receiver and transmitter are functioning normally.

4-12. The test points located on the various components serve to facilitate localizing troubles. Table 4-4 lists the voltages normally found at the various test points. Section VI contains terminal voltage and resistance diagrams as well as schematic and practical wiring diagrams. Table 6-1, "State of Relays for Various Control Positions," and table 6-2, "Current Required to Operate and Release Control Relays of Direction Finder Control C-567/GRD," are also included in Section VI. During trouble shooting, refer to section VI constantly. After a trouble has been located and remedied, check for normal operation by performing the applicable tests prescribed in section V.

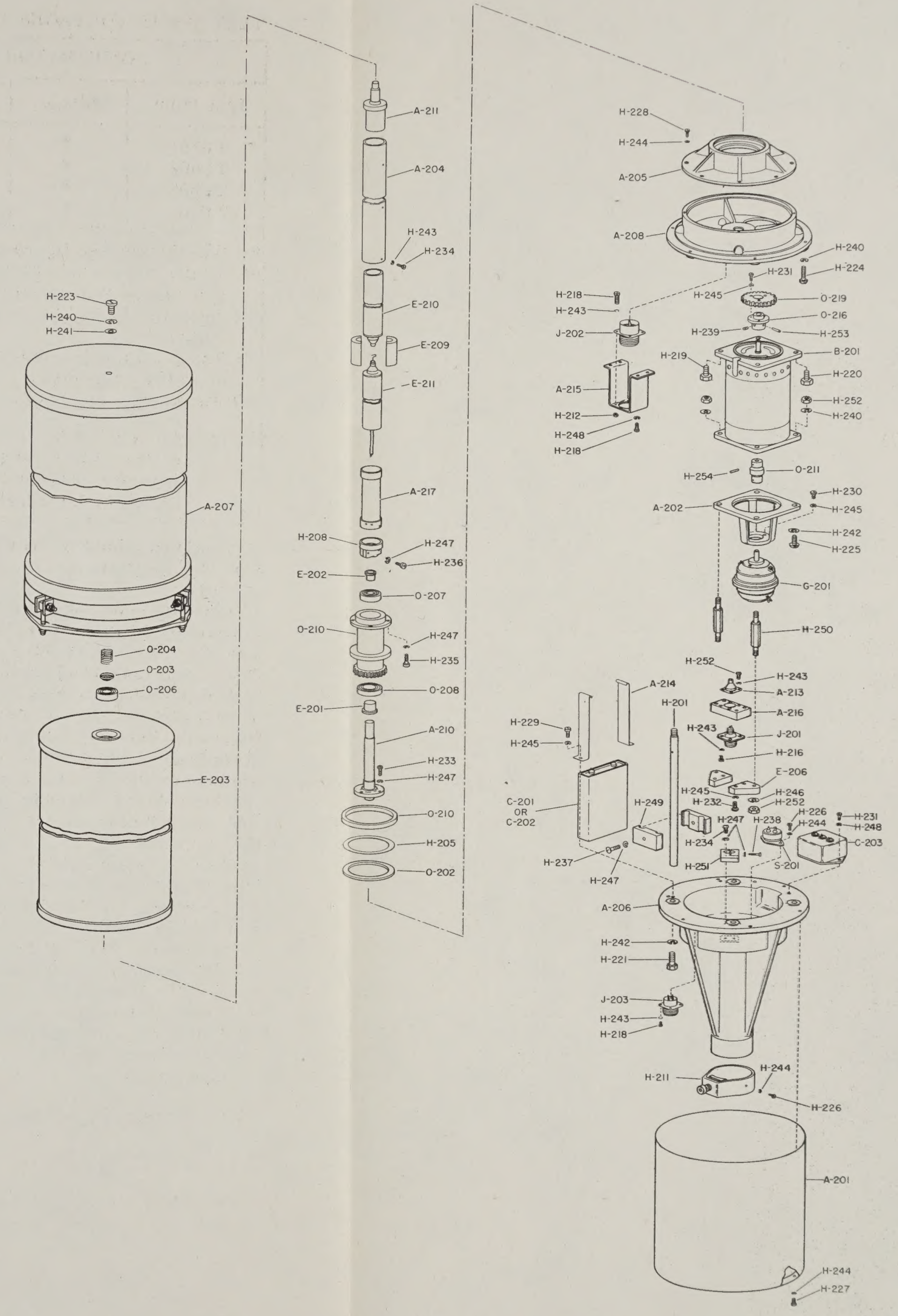
4-13. REPAIR OF ELECTRONIC COMPONENTS.

4-14. GENERAL. With the exception of those relays that are not hermetically sealed, the electronic component parts of Radio Direction Finder AN/CRD-6 cannot be repaired or serviced. When such a part is found defective, it must be replaced.

TABLE 4-4

TEST POINT VOLTAGES BY COMPONENT

AZIMUTH INDICATOR ID-260/GRD			
Test Point	Voltage	Test Point	Voltage
TP101	*	TP107	260Vdc
TP102	*	TP108	*
TP103	*	TP109	*
TP104	*	TP110	*
TP105	ground	TP111	*
TP106 A and B	*	TP112	*
DIRECTION FINDER CONTROL C-567/GRD			
TP301	1 Vrms	TP304	4.5 Vrms
TP302	ground	TP305	**22.5 Vrms
TP303	5 Vrms	TP306	265 Vdc
† DIRECTION FINDER CONTROL C-568/GRD			
TP401	220 Vdc	TP405	††10 Vrms
TP402	6 Vrms	TP406	ground
TP403	††1 Vrms	TP407	10 Vrms
TP404	13 Vrms	TP408	300 Vdc



A-201	Motor cover
A-202	Support
A-204	Tube support
A-205	Cover
A-206	Antenna base
A-207	Antenna cover
A-208	Gear housing
A-210	Gear support
A-211	Bearing support
A-213	Hood
A-215	Bracket
A-216	Block
A-217	Dipole support
B-201	Motor
C-201 or C-202	Capacitor
C-203	Capacitor
E-201	Insulator
E-202	Insulator
E-203	Reflector
E-206	Insulator
E-209	Insulator
E-210	Dipole
E-211	Dipole
G-201	Generator
H-201	Stud
H-205	Washer
H-208	Clamp
H-211	Clamp
H-212	Nut
H-216	Screw
H-218	Screw
H-220	Screw
H-221	Screw
H-223	Screw
H-224	Screw
H-225	Screw
H-226	Screw
H-227	Screw
H-228	Screw
H-229	Screw
H-230	Screw
H-233	Screw
H-234	Screw
H-235	Screw
H-237	Screw
H-238	Screw
H-240	Lock washer
H-241	Washer
H-242	Lock washer
H-243	Lock washer
H-244	Lock washer
H-245	Lock washer
H-246	Lock washer
H-247	Lock washer
H-248	Lock washer
H-249	Cable clamp
H-250	Stud
H-251	Clamp
H-252	Nut
H-253	Taper pin
H-254	Taper pin
J-201	Receptacle
J-202	Receptacle
J-203	Receptacle
O-202	Seal
O-203	Spring retainer
O-204	Spring
O-206	Ball bearing
O-207	Ball bearing
O-208	Ball bearing
O-210	Retaining ring
O-211	Coupling
O-216	Gear hub
O-219	Spur gear
S-201	Thermostat

Figure 4-9. Antenna AS-449/GRD-- Exploded View

TABLE 4-4

TEST POINT VOLTAGES BY COMPONENT (Cont)

COMPARATOR CM-23/GR			
Test Point	Voltage	Test Point	Voltage
TP501	⚲	TP505	
TP502	⚲	TP506	350 Vdc
TP503	⚲	TP507	ground
TP504	⚲		

* Waveforms, see figure 5-14.
** This voltage level set with potentiometer R313 before taking readings at other test points.
† "SINGLE-PARALLEL" switch S410 placed at "SINGLE."
†† These voltage levels set with potentiometers R462 and R463 before taking readings at other test points.
⚲ Waveforms, see figure 5-9.

NOTE: All values ± 20 percent.
All test points except TP112 located on rear of respective component. TP112 located on the bottom of azimuth indicator chassis.

4-15. NON-HERMETICALLY SEALED RELAYS. Inspect and maintain non-hermetically sealed relays as follows:

a. Check to make sure that the moving and stationary contacts make positive contact and are directly in line with each other when they come together. If either of these requirements is not met, or if the contacts are burned, pitted, or corroded, the relay must be replaced.

b. When necessary to clean relay contacts, a clean burnishing tool may be used if available. Place the blade between the contacts and move it back and forth while pressing the contacts together. If the contacts require further cleaning, apply carbon tetrachloride, Federal Specification P-S-661, with a toothpick. Clean the contacts with the flat side of another clean, dry toothpick. Again burnish, using a clean blade of the burnishing tool. If a burnishing tool is not available, apply carbon tetrachloride with a toothpick and clean with the flat side of a clean, dry toothpick or with similar material. Dry and polish the contacts by drawing a strip of smooth, hard-finish paper between the contacts while pressing them together lightly. Soft paper which will disintegrate and leave particles on the contact surfaces must not be used. If the relay contacts cannot be properly cleaned, or if they are worn down replace the relay.

4-16. OVERHAUL OF MECHANICAL COMPONENTS.

4-17. ANTENNA AS-449/GRD. (See figure 4-9.)

4-18. If it is determined that trouble lies in one of the components mounted in Antenna AS-449/GRD, lower Mast AB-157/CRD-6 in accordance with the instructions in the applicable handbook of "Erection and Maintenance Instructions." It is not necessary to disassemble the antenna from the mast to gain access to the components mounted below the housing (A-208, figure 4-9). Simply remove the attaching screws (H-227) and slide the motor generator cover (A-201) back toward the mast. If necessary to further disassemble the antenna, remove the housing (A-207) by removing the six attaching screws (H-224) and then remove the rotating parasitic reflector (E-203). The remainder of the required disassembly may now be completed in the order shown in figure 4-9.

4-19. AZIMUTH INDICATOR ID-260/GRD.

4-20. POSITIONING PHASEMETER DAMPING DISC. (See figure 4-10.) To position the phasemeter damping disc (O-107) between the damping magnets (E-103), first remove the retainer ring (O-105) and the dial shield (MS-103). Screw the puller-disc removing tool (see figure 3-1) onto the hub (O-109). Remove the cover plates (A-105). Using the removing tool, gently push or pull the damping disc until its flange is exactly midway between the damping magnets, as viewed through the inspection slots. Rotate the damping disc to make sure the flange always lies approximately midway between the magnets and that there is no rubbing.

4-21. DISASSEMBLY OF PHASEMETER. (See figure 4-10.) If necessary to disassemble the phasemeter to replace defective parts, follow the order of disassembly shown in figure 4-10.

4-22. PHASEMETER REMOVAL. (See figure 4-10.) If necessary to remove the phasemeter from the azimuth indicator, proceed as follows: Pull the phasemeter plug (P-101) from the jack (J-104). Remove the four screws (H-155) and washers (H-199) from the retaining rings (O-127 and O-123). Pull the phasemeter forward out of the azimuth indicator. To reinstall the phasemeter, reverse the removal procedure.

4-23. CABLE FABRICATION.

4-24. Figures 4-11 through 4-17 provide terminating and fabrication instructions for r-f cables CG-278B/U, CG-967/U, CG-898/U, and CG-911/U. Figures 4-18 and 4-19 show the terminating and shielding procedures for multi-conductor cables. Figure 4-20 is the fabrication drawing for cable CX-2015/U, which must be modified for multi-remote station installation. Figures 6-9 through 6-28 are contact-to-contact diagrams of the remainder of the AN/CRD-6 cables.

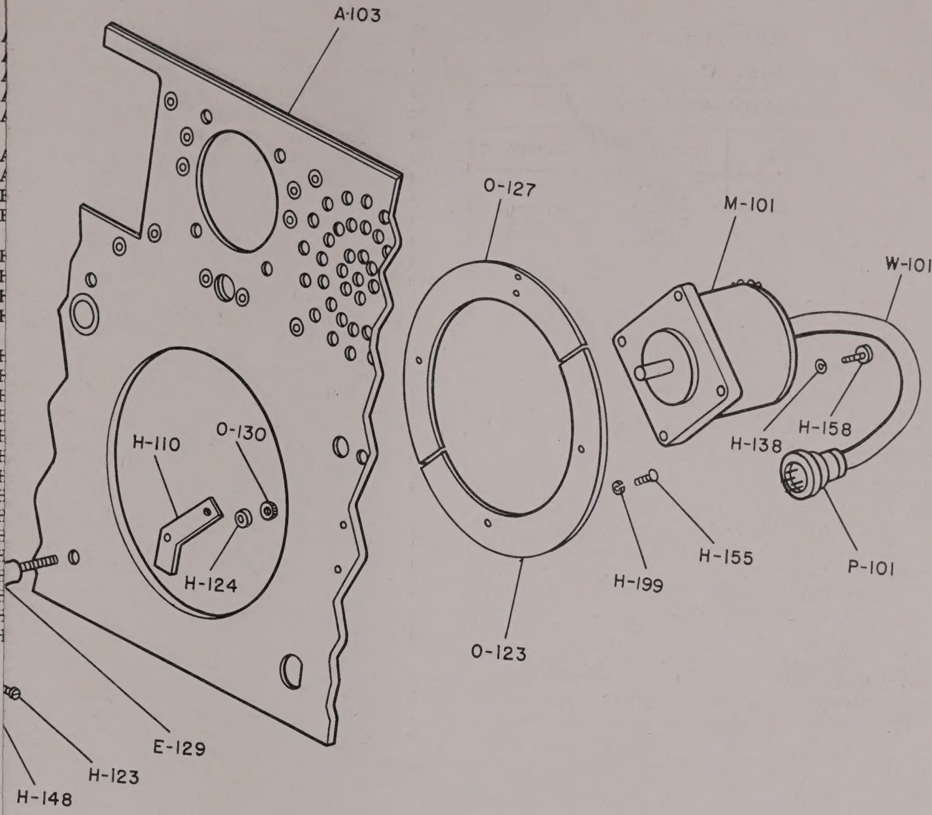

A-103
O-127
M-101
W-101
H-110
O-130
H-158
H-138
H-124
H-155
P-101
H-199
O-123
E-129
H-123
H-148

TABLE 4-4

TEST POINT VOLTAGES BY COMPONENT (Cont)

COMPARATOR CM-23/GR			
Test Point	Voltage	Test Point	Voltage
TP501	♦	TP505	
TP502	♦	TP506	350 Vdc
TP503	♦	TP507	ground
TP504	♦		

* Waveforms, see figure 5-14.
** This voltage level set with potentiometer R313 before taking readings at other test points.
† "SINGLE-PARALLEL" switch S410 placed at "SINGLE."
†† These voltage levels set with potentiometers R462 and R463 before taking readings at other test points.
♦ Waveforms, see figure 5-9.

NOTE: All values ± 20 percent.
All test points except TP112 located on rear of respective component. TP112 located on the bottom of azimuth indicator chassis.

4-15. NON-HERMETICALLY SEALED RELAYS. Inspect and maintain non-hermetically sealed relays as follows:

a. Check to make sure that the moving and stationary contacts make positive contact and are directly in line with each other when they come together. If either of these requirements is not met, or if the contacts are burned, pitted, or corroded, the relay must be replaced.

b. When necessary to clean relay contacts, a clean burnishing tool may be used if available. Place the blade between the contacts and move it back and forth while pressing the contacts together. If the contacts require further cleaning, apply carbon tetrachloride, Federal Specification P-S-661, with a toothpick. Clean the contacts with the flat side of another clean, dry toothpick. Again burnish, using a clean blade of the burnishing tool. If a burnishing tool is not available, apply carbon tetrachloride with a toothpick and clean with the flat side of a clean, dry toothpick or with similar material. Dry and polish the contacts by drawing a strip of smooth, hard-finish paper between the contacts while pressing them together lightly. Soft paper which will disintegrate and leave particles on the contact surfaces must not be used. If the relay contacts cannot be properly cleaned, or if they are worn down replace the relay.

4-16. OVERHAUL OF MECHANICAL COMPONENTS.

4-17. ANTENNA AS-449/GRD. (See figure 4-9.)

4-18. If it is determined that trouble lies in one of the components mounted in Antenna AS-449/GRD, lower Mast AB-157/CRD-6 in accordance with the instructions in the applicable handbook of "Erection and Maintenance Instructions." It is not necessary to disassemble the antenna from the mast to gain access to the components mounted below the housing (A-208, figure 4-9). Simply remove the attaching screws (H-227) and slide the motor generator cover (A-201) back toward the mast. If necessary to further disassemble the antenna, remove the housing (A-207) by removing the six attaching screws (H-224) and then remove the rotating parasitic reflector (E-203). The remainder of the required disassembly may now be completed in the order shown in figure 4-9.

4-19. AZIMUTH INDICATOR ID-260/GRD.

4-20. POSITIONING PHASEMETER DAMPING DISC. (See figure 4-10.) To position the phasemeter damping disc (O-107) between the damping magnets (E-103), first remove the retainer ring (O-105) and the dial shield (MS-103). Screw the puller-disc removing tool (see figure 3-1) onto the hub (O-109). Remove the cover plates (A-105). Using the removing tool, gently push or pull the damping disc until its flange is exactly midway between the damping magnets, as viewed through the inspection slots. Rotate the damping disc to make sure the flange always lies approximately midway between the magnets and that there is no rubbing.

4-21. DISASSEMBLY OF PHASEMETER. (See figure 4-10.) If necessary to disassemble the phasemeter to replace defective parts, follow the order of disassembly shown in figure 4-10.

4-22. PHASEMETER REMOVAL. (See figure 4-10.) If necessary to remove the phasemeter from the azimuth indicator, proceed as follows: Pull the phasemeter plug (P-101) from the jack (J-104). Remove the four screws (H-155) and washers (H-199) from the retaining rings (O-127 and O-123). Pull the phasemeter forward out of the azimuth indicator. To reinstall the phasemeter, reverse the removal procedure.

4-23. CABLE FABRICATION.

4-24. Figures 4-11 through 4-17 provide terminating and fabrication instructions for r-f cables CG-278B/U, CG-967/U, CG-898/U, and CG-911/U. Figures 4-18 and 4-19 show the terminating and shielding procedures for multi-conductor cables. Figure 4-20 is the fabrication drawing for cable CX-2015/U, which must be modified for multi-remote station installation. Figures 6-9 through 6-28 are contact-to-contact diagrams of the remainder of the AN/CRD-6 cables.

A-103	Panel
A-105	Cover plate
A-106	Hub plate
A-107	Cover plate
A-126	Housing and magnet assembly
A-127	Stop plate
A-133	Adjusting plate
E-103	Magnet
E-129	Phasemeter lock knob
H-109	Screw
H-110	Phasemeter lock
H-111	Screw
H-113	Damping adjustment lock screw
H-114	Clamp
H-115	Pinion lock
H-119	Pointer
H-123	Screw
H-124	Washer
H-132	Screw
H-138	Lock washer
H-147	Washer
H-148	Lock washer
H-155	Screw
H-158	Screw
H-164	Screw
H-166	Screw
H-169	Screw
H-180	Screw
H-188	Azimuth adjustment lock screw
H-199	Lock washer
I-103	Dial
M-101	Phasemeter
MS-103	Dial shield
O-105	Retainer ring
O-106	Support ring
O-107	Damping disc
O-109	Disc hub
O-112	Azimuth adjustment pinion
O-113	Damping adjustment pinion
O-114	Gasket
O-115	Dial gear
O-123	Retaining ring
O-127	Retaining ring
O-128	Lock washer
O-130	Retaining ring
O-138	Retainer
P-101	Plug
W-101	Cable assembly

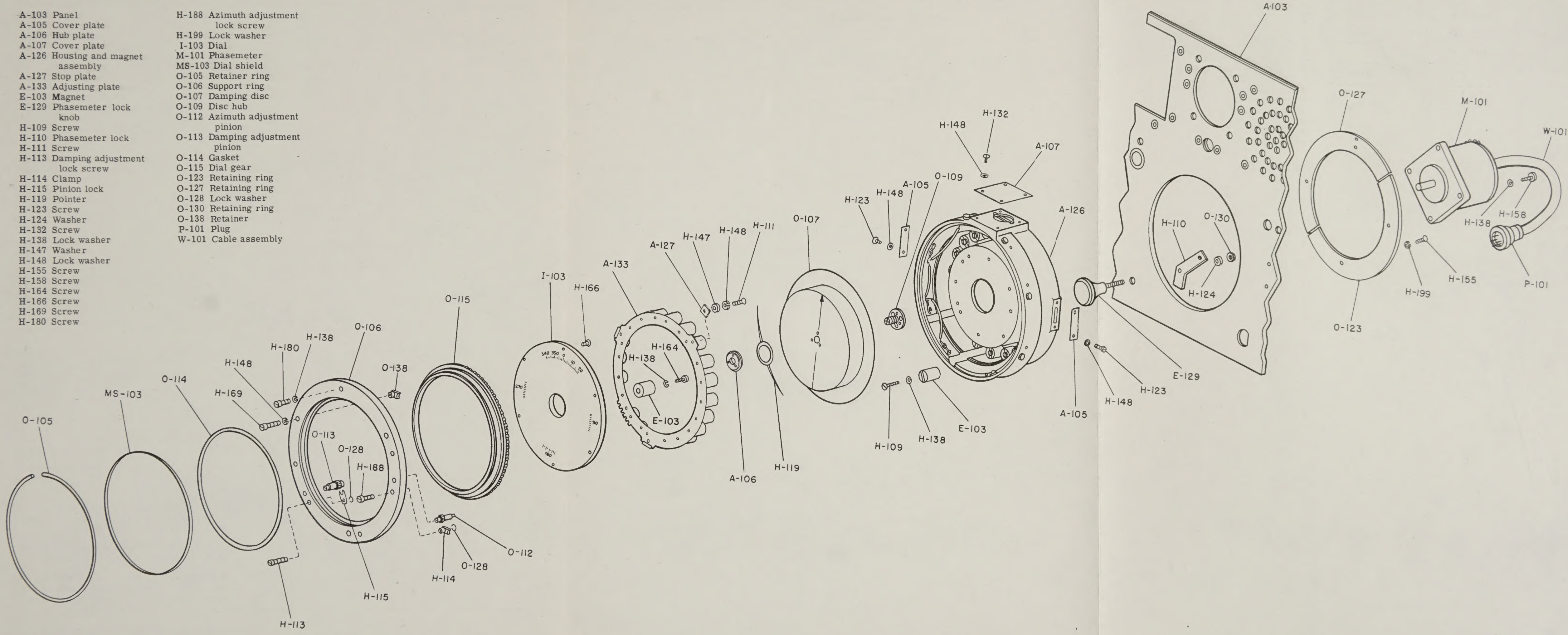
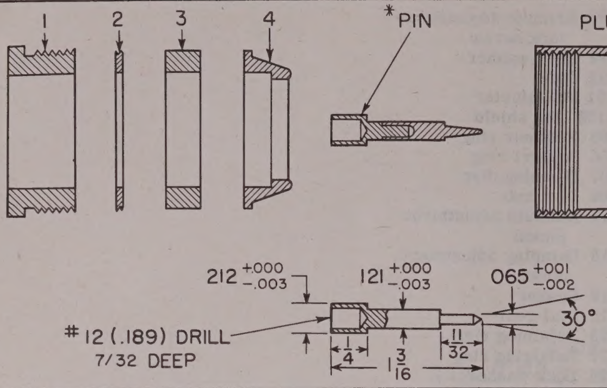
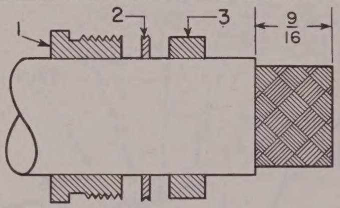


Figure 4-10. Phasemeter, Azimuth Indicator ID-260/GRD - Exploded View



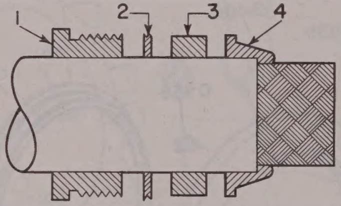
* REPLACE PIN FURNISHED WITH PLUG WITH THE ONE SHOWN

STEP

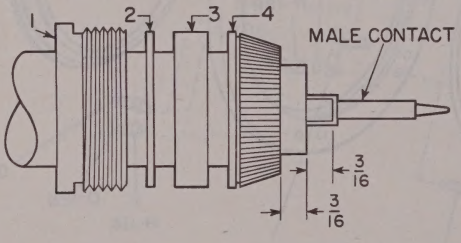


1 Slide parts 1, 2, and 3 on cable in the order indicated.

2 Cut back Vinylite jacket square and even 9/16 inch. Be careful not to nick or cut braid wires.



3 Slide part 4 on cable. Make sure part 4 clears all braid wires and that its internal shoulder rests squarely against the end of the Vinylite jacket.



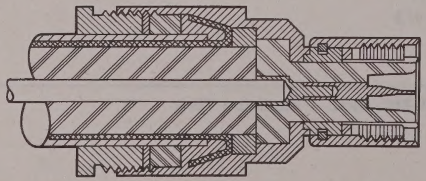
4 Unbraid shield wires, spread open and lay back on part 4 without wires crossing each other.

5 Cut off excess braid wire length so that each wire will end before touching the shoulder of part 4.

6 Cut off cable dielectric 3/16 inch from the end of the braid wires. Be sure to cut square and even. Do not nick center conductor.

7 Cut center conductor 3/16 inch from end of cable dielectric and tin.

8 Solder male contact carefully and remove excess solder. Be careful that solder or flux does not get on cable dielectric.

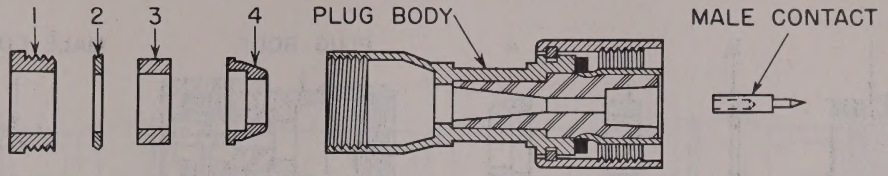


9 Insert cable into plug body as far as it will go.

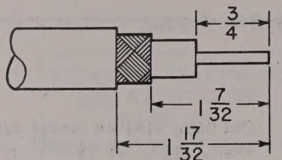
10 Push parts 3 and 2 into body and tighten part 1.

11 Hold body with wrench and tighten part 1. Do not allow body or cable to rotate during this operation.

Figure 4-11. Terminating Procedure, Cable RF-17A/U (Modified) and Connector UG-495/U (Modified)



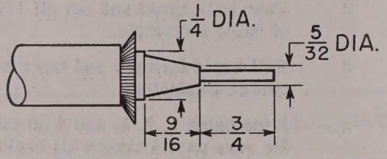
STEP



1 Cut back Vinylite jacket square and even 1-17/32 inch. Be careful not to nick or cut braid wires.

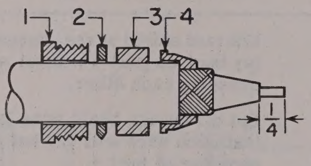
2 Cut back braid wires square and even 1-7/32 inch. Be careful not to cut or nick cable dielectric.

3 Cut back cable dielectric square and even 3/4 inch. Be careful not to nick or cut center conductor.



4 Flare back braid wires as shown.

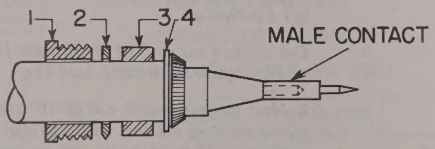
5 Cut taper on cable dielectric to dimensions shown. (Cable tapering tool MX-103/U may be used.)



6 Pull braid forward and taper toward center.

7 Slide parts 1, 2, 3, and 4 on cable. Be sure part 4 clears all braid wires and its internal shoulder rests squarely against end of Vinylite jacket.

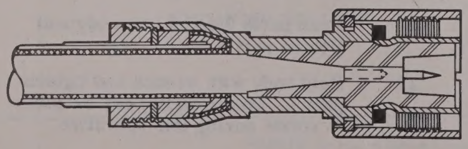
8 Cut center conductor to dimension shown and tin.



9 Unbraid shield wires and lay back on part 4 without wires crossing each other.

10 Cut off excess braid wire length so that each wire will end before touching shoulder of part 4.

11 Solder male contact carefully and remove excess solder. Be careful that solder or flux does not get on end of cable dielectric.

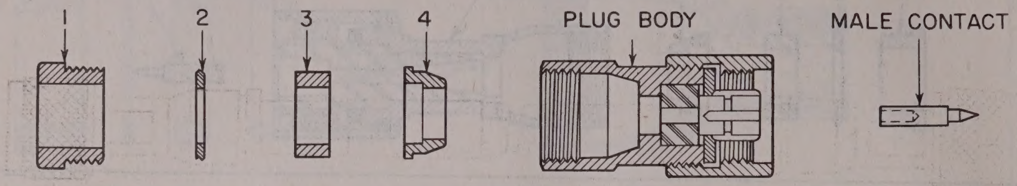


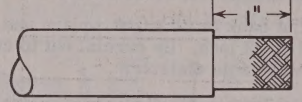
12 Insert cable into plug body as far as it will go.

13 Push parts 2 and 3 into body and tighten part 1.

14 Hold body with wrench and tighten part 1. Do not allow body or cable to rotate during this operation.

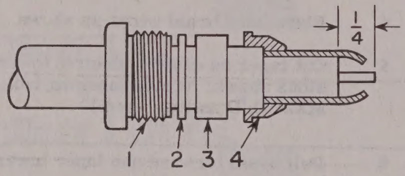
Figure 4-12. Terminating Procedure, Cable RG-9B/U and Connector UG-59A/U or Connector UG-60A/U





STEP

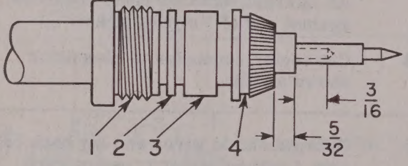
1 Cut back Vinylite jacket square and even 1 inch. Be careful not to nick or cut braid wires.



2 Push back braid and cut off 1/4 inch of cable dielectric.

3 Pull braid forward and taper toward center conductor.

4 Slide parts 1, 2, 3, and 4 on cable. Be sure part 4 clears all braid wires and its internal shoulder rests squarely against Vinylite jacket.



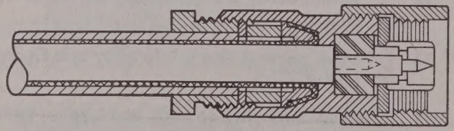
5 Unbraid shield wires, spread open and lay back on part 4 without wires crossing each other.

6 Cut off excess braid wire length so that each wire will end before touching shoulder of part 4.

7 Cut off cable dielectric 5/32 inch from end of braid wires. Be sure to cut square and even and do not nick center conductor.

8 Cut center conductor 3/16 inch from end of cable dielectric and tin.

9 Solder male contact carefully and remove excess solder. Be careful that solder or flux does not get on end of cable dielectric.

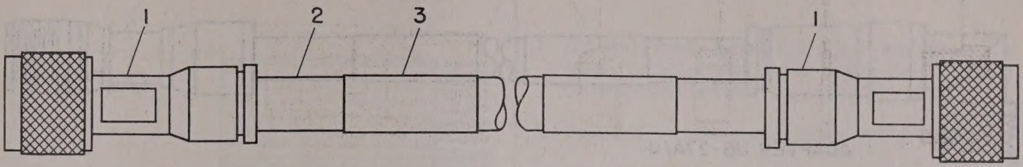


10 Insert cable into plug body as far as it will go.

11 Push parts 2 and 3 into body and tighten part 5.

12 Hold body with wrench and tighten part 1. Do not allow body or cable to rotate during this operation.

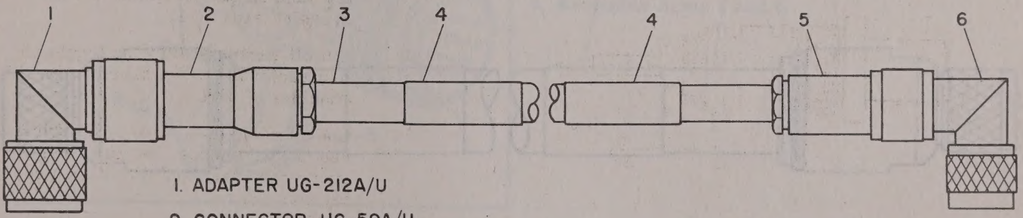
Figure 4-13. Terminating Procedure, Cable RG-9B/U and Connector UG-21B/U



1. CONNECTOR UG-59A/U
2. COAXIAL CABLE RG-9B/U
3.

FEDERAL TELEPHONE AND RADIO CORP. PART NO.	CABLE MARKER NUMBERS		
	LINE 1	LINE 2	LINE 3
NL-69689-2-1	NL-69630-2	CG-278B/U	(200 FT.)

Figure 4-14. Cable CG-278B/U - Fabrication Drawing

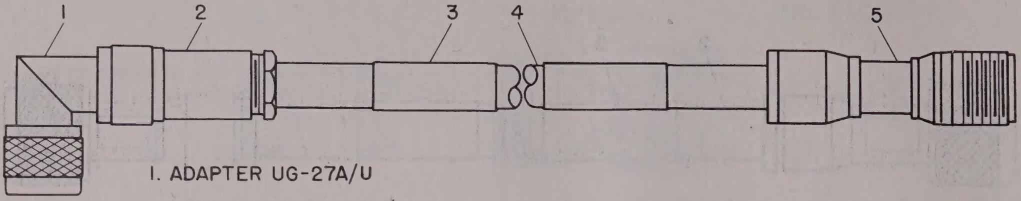


1. ADAPTER UG-212A/U
2. CONNECTOR UG-59A/U
3. COAXIAL CABLE RG-9B/U
4.

FEDERAL TELEPHONE AND RADIO CORP. PART NO.	CABLE MARKER NUMBERS		
	LINE 1	LINE 2	LINE 3
NL-69689-2-16	NL-70130-2	CG-967/U	(9 FT.)

5. CONNECTOR UG-21B/U
6. ADAPTER UG-27A/U

Figure 4-15. Cable CG-967/U - Fabrication Drawing

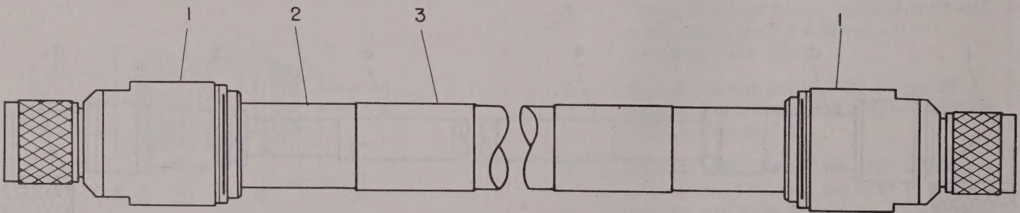


1. ADAPTER UG-27A/U
2. CONNECTOR UG-21B/U
3.

FEDERAL TELEPHONE AND RADIO CORP. PART NO.	CABLE MARKER NUMBERS		
	LINE 1	LINE 2	LINE 3
NL-69689-2-4	NL-70119-2-2	CG-898/U	(4 FT. 2 IN.)
NL-69689-2-17	NL-70119-2-1	CG-898/U	(3 FT. 6 IN.)

4. COAXIAL CABLE RG-9B/U
5. CONNECTOR UG-60A/U

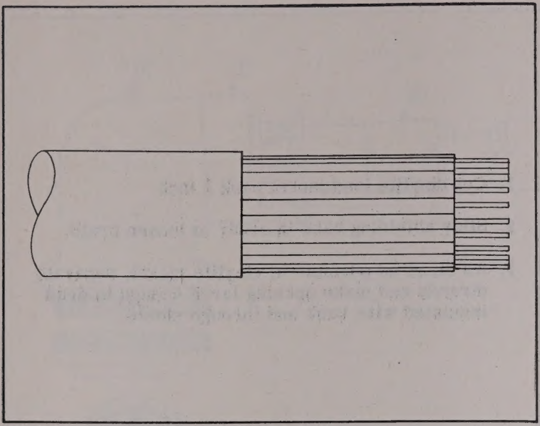
Figure 4-16. Cable CG-898/U - Fabrication Drawing



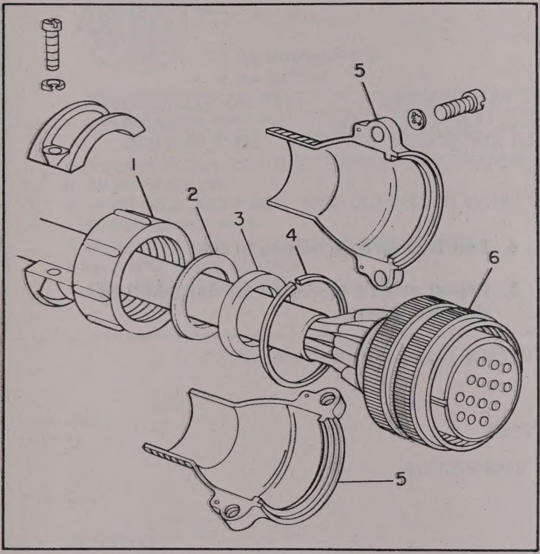
1. CONNECTOR UG-495/U (MODIFIED)
2. COAXIAL CABLE SIMILAR TO RG-17A/U, EXCEPT THAT IT HAS 2 SILVER-PLATED BRAIDS SIMILAR TO THE BRAIDS ON COAXIAL CABLE RG-9B/U
3.

FEDERAL TELEPHONE AND RADIO CORP. PART NO.	CABLE MARKER NUMBERS		
	LINE 1	LINE 2	LINE 3
NL-69689-2-2	NL-70116-2	CG-911/U	(100 FT.)

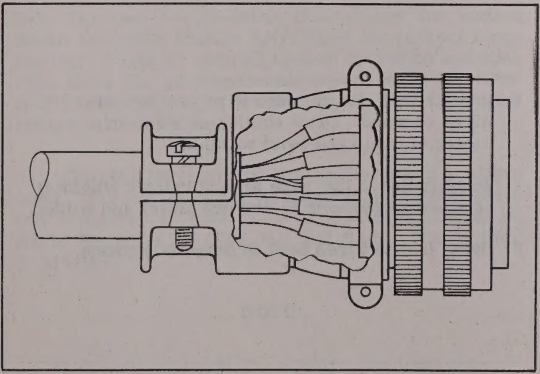
Figure 4-17. Cable CG-911/U - Fabrication Drawing



1. Cut vinyl cable jacket 1-3/4 inch back from leads, being careful not to damage insulation on individual leads.
2. Peel 3/8-inch insulation from end of each lead.
3. Tin exposed leads.
4. If any leads are shielded, ground shields in accordance with figure 4-19.

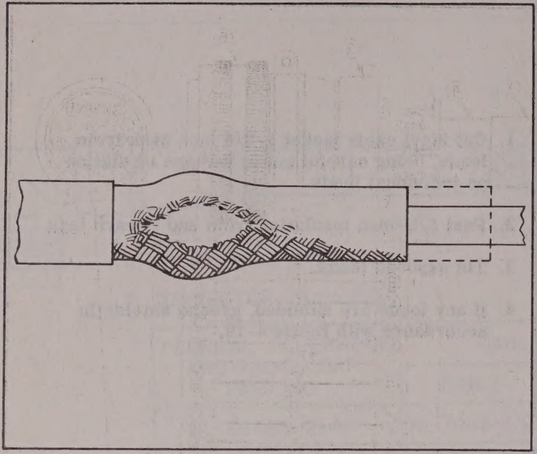


5. Slide items 1, 2, 3, and 4 over cable.
6. Slip 3/4-inch length of proper sized vinyl tubing over each lead.
7. Solder leads to corresponding contacts.
8. Assemble items 5 and 6.

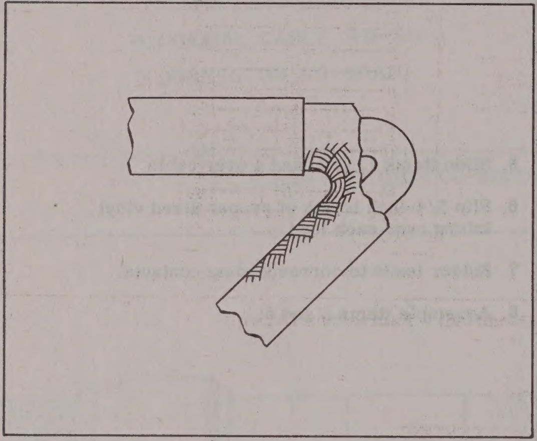


9. With 3/4-inch Scotch electrical tape, build up that part of cable over which clamp fastens to provide tight fit.
10. Secure clamp to cable and connector.

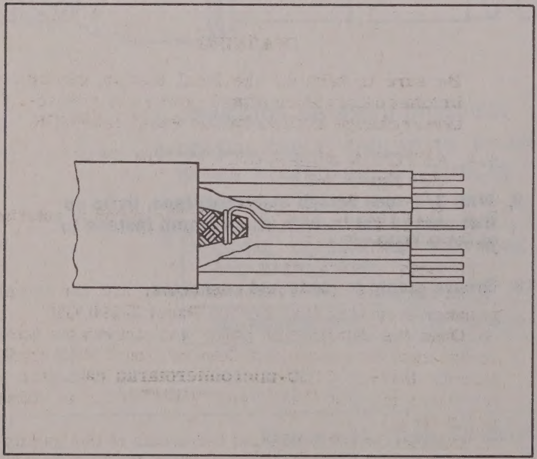
Figure 4-18. Terminating Procedure, Multiconductor Cable



1. Cut vinylite lead jacket back 1 inch.
2. Slide shielding back in order to loosen braid.
3. As close as possible to vinylite jacket, separate strands and make opening large enough to draw insulated wire back and through shield.

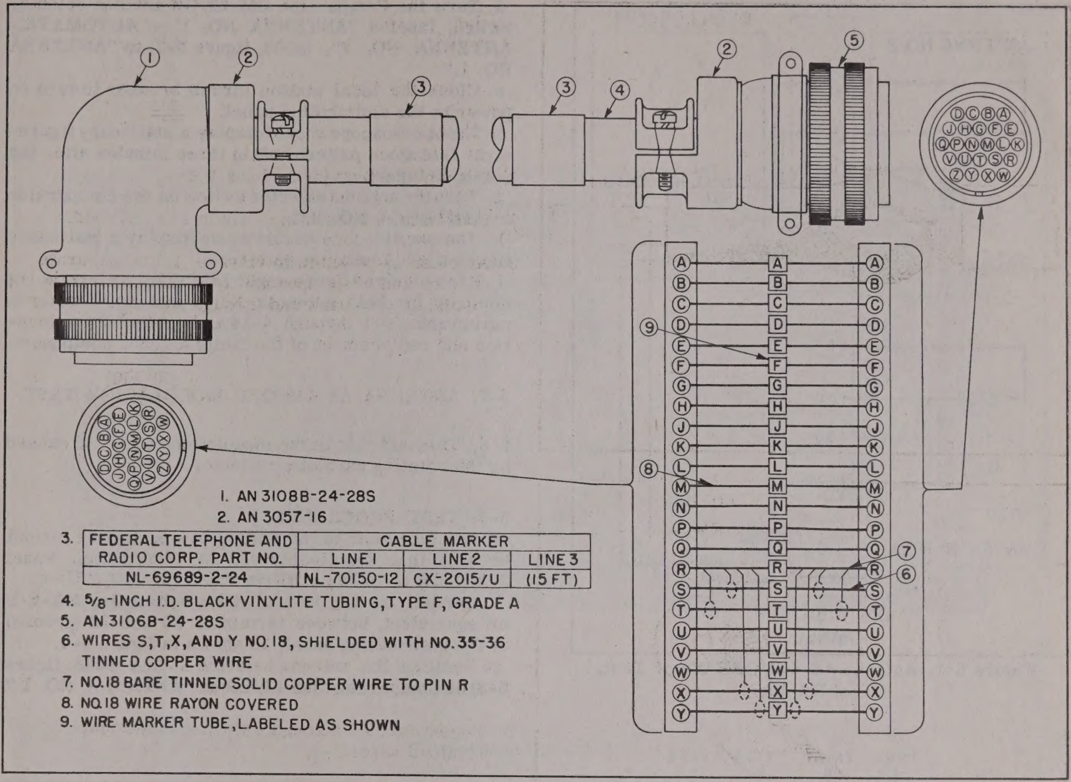


4. Pull lead through hole in braid.
5. Repeat steps 1 through 4 for any additional shielded wires.



6. If more than one shielded wire present, fan wires outward. Draw shields of wires into center of cable and twist together.
7. Wrap required bus wire around twisted shielding as close as possible to vinylite jacket and solder.
8. Bring fanned wires back to original position.

Figure 4-19. Finishing and Grounding Shields, Multiconductor Cable



1. AN 3108B-24-28S
2. AN 3057-16
3.

FEDERAL TELEPHONE AND RADIO CORP. PART NO.	CABLE MARKER		
	LINE 1	LINE 2	LINE 3
NL-69689-2-24	NL-70150-12	CX-2015/U	(15 FT)

4. 5/8-INCH I.D. BLACK VINYLITE TUBING, TYPE F, GRADE A
5. AN 3106B-24-28S
6. WIRES S, T, X, AND Y NO. 18, SHIELDED WITH NO. 35-36 TINNED COPPER WIRE
7. NO. 18 BARE TINNED SOLID COPPER WIRE TO PIN R
8. NO. 18 WIRE RAYON COVERED
9. WIRE MARKER TUBE, LABELED AS SHOWN

Figure 4-20. Cable CX-2015/U (Modified) - Fabrication Drawing

SECTION V

ALIGNMENT AND TESTING

5-1. GENERAL.

5-2. This section contains instructions for testing Radio Direction Finder AN/CRD-6 for correct functioning. Tests for overall system operation and specific tests for all components except Radio Receiver R-278A/GR and Radio Transmitter T-216/GR are included in this section.

5-3. Only the receiver and transmitter require alignment. For instructions on aligning and testing these two components, refer to the applicable handbooks on Radio Receiver R-278A/GR and Radio Transmitter T-216/GR.

NOTE

It is assumed that the system has been correctly installed and calibrated before any of the following tests are performed.

WARNING

Be sure to turn off the local station circuit breaker before attempting to make any connection or change at Distribution Panel J-390/GR.

5-4. ANTENNA AS-449/GRD MOTOR TEST. (See figure 5-1.)

5-5. This test is used to check the speed of rotation of the antenna motor.

5-6. TEST PROCEDURE.

a. At the local station, shut off power with the circuit breaker supplying Distribution Panel J-390/GR.

b. Open the distribution panel and connect the horizontal input terminals of a Dumont model 304H oscilloscope through a 100-micromicrofarad capacitor to the buses marked "115V" and "NEUTRAL," as shown in figure 5-1.

c. Connect the vertical input terminals of the oscilloscope to TP101 and TP105 (ground) on the rear of Azimuth Indicator ID-260/GRD (see figure 5-2).

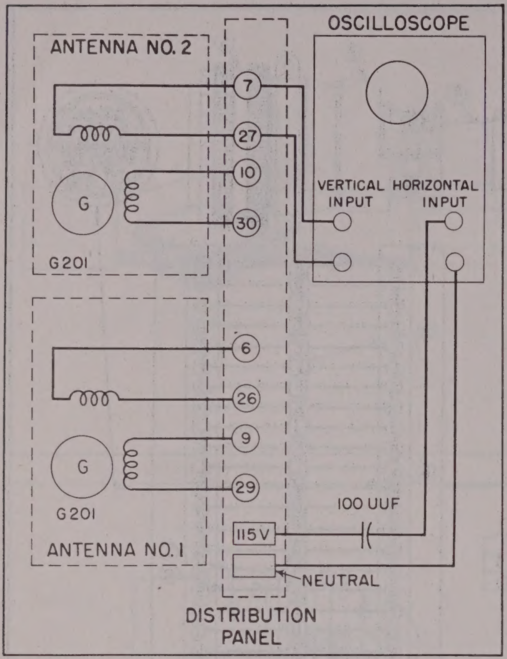


Figure 5-1. Antenna AS-449/GRD Motor Test, Test Set-Up

d. Turn the Comparator CM-23/GR antenna selector switch, labeled "ANTENNA NO. 1 - AUTOMATIC-ANTENNA NO. 2", (S503, figure 5-3) to "ANTENNA NO. 1."

e. Close the local station circuit breaker to turn on power to the distribution panel.

f. The oscilloscope should display a stationary figure-eight Lissajous pattern within three minutes after the power is turned on.

g. Turn the antenna selector switch on the comparator to "ANTENNA NO. 2."

h. The oscilloscope should again display a stationary figure-eight Lissajous pattern.

i. If the required figure-eight Lissajous pattern is not obtained for both antennas No. 1 and No. 2, refer to paragraphs 4-7 through 4-14 and table 4-3 for location and replacement of the faulty antenna component.

5-7. ANTENNA AS-449/GRD MODULATION TEST.

5-8. This test checks the modulation of the r-f caused by the rotating parasitic reflector.

5-9. TEST PROCEDURE.

a. Shut off power to the system by opening the circuit breaker that supplies power to Distribution Panel J-390/GR or to Distribution Panel SB-349/CRD-6.

b. Connect an a-c vacuum-tube voltmeter, ME-6/U or equivalent, between terminals 20 and 12 (ground) of the distribution panel, as shown in figure 5-4.

c. Position the antenna selector switch (S503, figure 5-3) on Comparator CM-23/GR at "ANTENNA NO. 1."

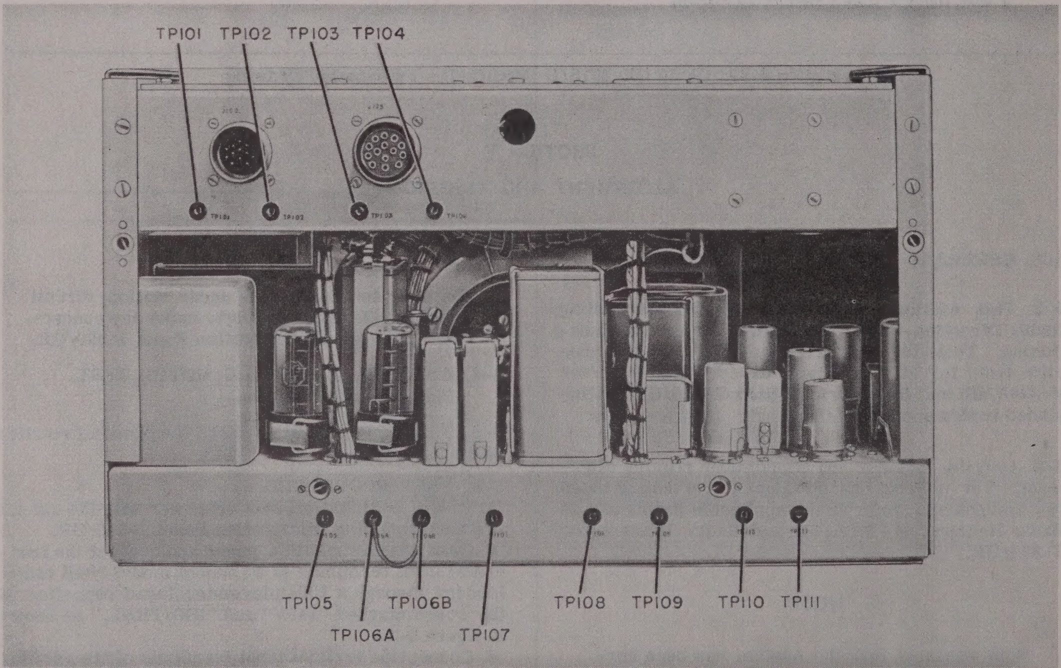


Figure 5-2. Azimuth Indicator ID-260/GRD - Rear View

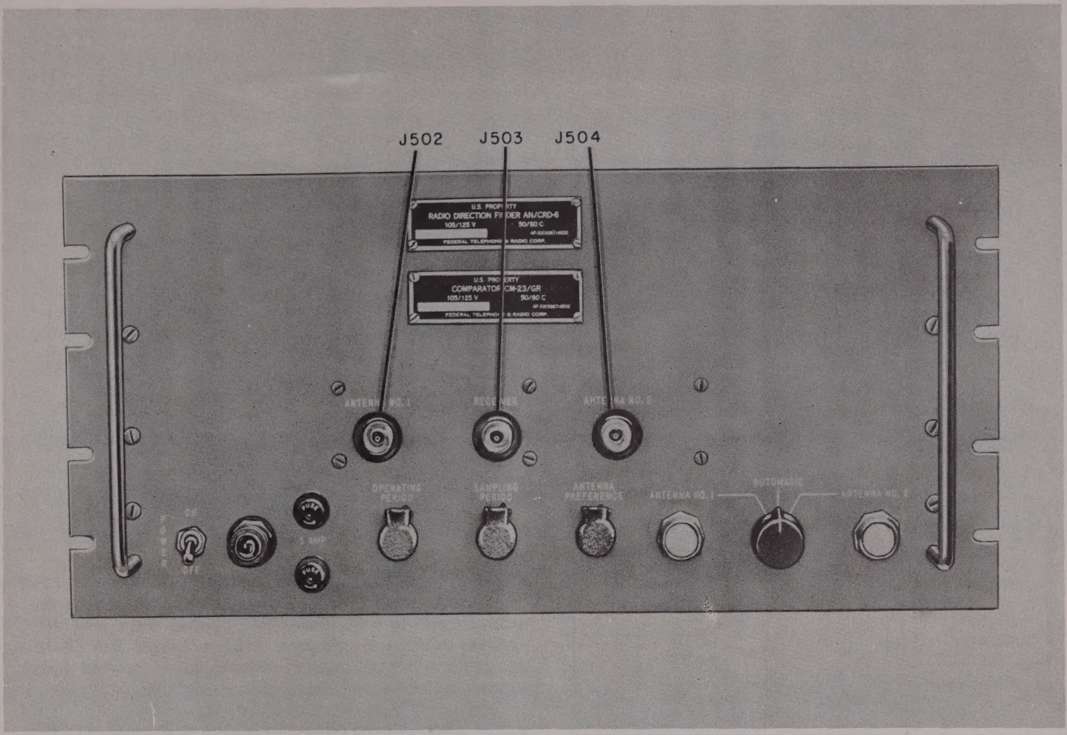


Figure 5-3. Comparator CM-23/GR - Front View

d. Set the r-f attenuator on Radio Transmitter T-216/GR to 100,000 microvolts.

e. Tune the transmitter and Radio Receiver R-278A/GR to the same frequency.

f. Close the circuit breaker and turn on power to the transmitter, receiver, comparator, and antennas.

g. Allow five minutes for the equipment to warm up before taking any readings.

h. The voltmeter should read approximately 1-1/2 volts, plus or minus 1/2-volt.

i. If the voltmeter does not show the required voltage, check for defective interconnecting cables and for proper rotation of the parasitic reflector. To observe the reflector, remove the antenna housing as outlined in paragraph 4-18.

j. If the voltmeter reads the required voltage, position the comparator antenna selector switch at "ANTENNA NO. 2" and repeat step h and, if necessary, step i, for antenna No. 2.

5-10. COMPARATOR CM-23/GR OPERATING PERIOD TEST.

5-11. This test checks for proper duration of the operating period.

5-12. TEST PROCEDURE.

a. Place the circuit breaker-type switch (S301, figure 5-5) on Direction Finder Control C-567/GRD at "ON."

b. Make sure the "POWER" switch on Radio Receiver R-278A/GR is at "OFF."

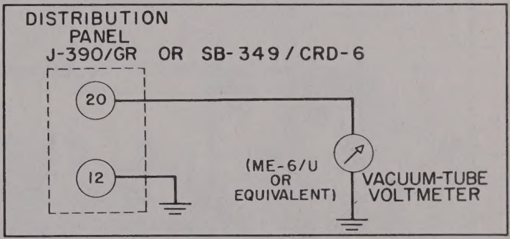


Figure 5-4. Antenna AS-449/GRD Modulation Test, Test Set-Up

c. Turn the antenna selector switch (S503, figure 5-3) on Comparator CM-23/GR to "AUTOMATIC."

d. Allow five minutes for the equipment to warm up.

e. Use a watch with a sweep second hand to measure the length of time the antenna indicator lamp (I501 or I502) that is illuminated for the longer period remains lighted. If this lamp does not remain illuminated for approximately the required three seconds, adjust the "OPERATING PERIOD" potentiometer (R529) until the operating period is of this duration.

5-13. COMPARATOR CM-23/GR SAMPLING PERIOD TEST.

5-14. This test checks for proper length of the sampling period. The operating period test, paragraph 5-10, must be performed before this test is made.

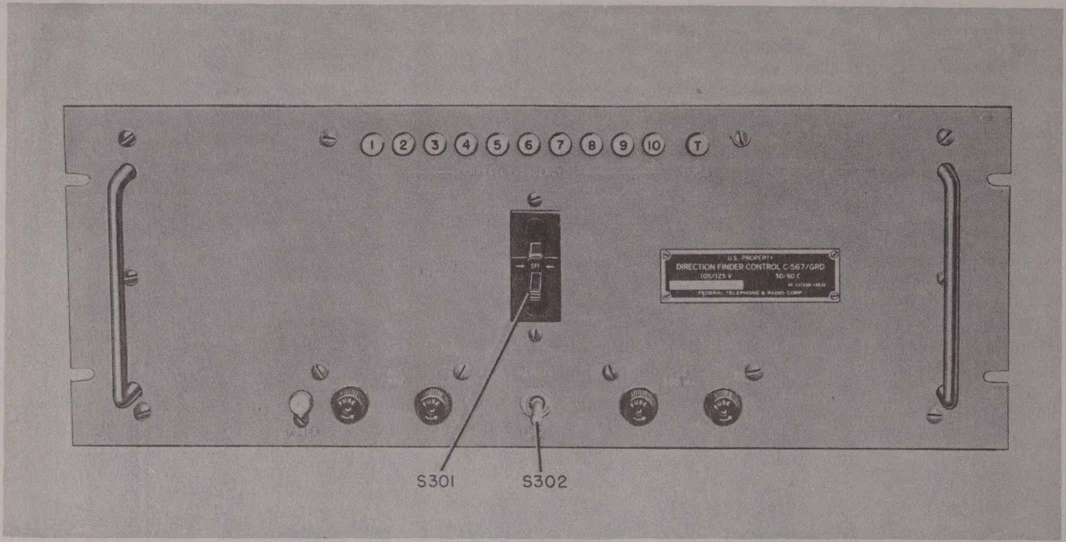

1
2
3
4
5
6
7
8
9
10
T
OFF
U.S. PROPERTY
DIRECTION FINDER CONTROL C-567/GRD
105/125 V
50/60 C
FEDERAL TELEPHONE & RADIO CORP.
S301
S302

Figure 5-5. Direction Finder Control C-567/GRD - Front View

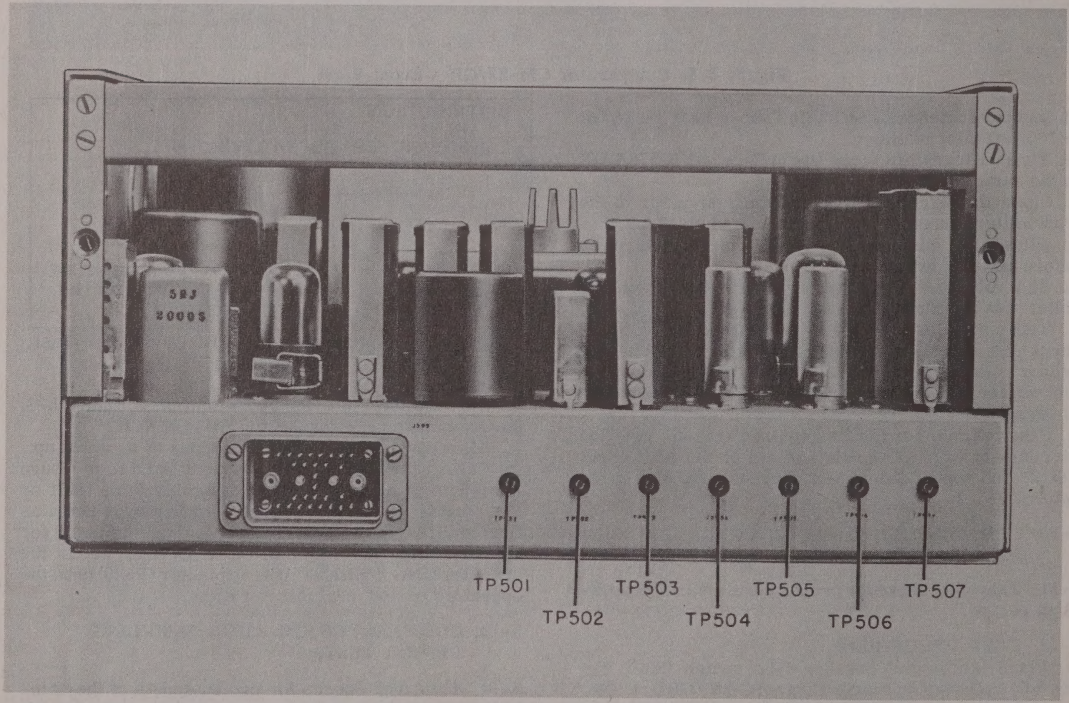


Figure 5-6. Comparator CM-23/GR - Rear View

5-15. TEST PROCEDURE.

a. Connect the vertical input terminals of a long-persistence screen oscilloscope, Dumont Model 304H, to TP505 and TP507 (ground) on the rear of Comparator CM-23/GR (see figure 5-6), as shown in figure 5-7.

b. Place the circuit-breaker type switch (S301, figure 5-5) on Direction Finder Control C-567/GRD at "ON."

c. If Radio Receiver R-278A/GR was previously turned on, make sure it is turned off.

d. Adjust the sweep on the oscilloscope until the pattern is stationary. With antenna No. 2 the preferred antenna, the pattern should consist of a long trace followed by a short break, as shown in figure 5-7. The length of the break should be one-tenth the length of the trace, representing the 0.3-second sampling period as compared with the 3-second operating period.

e. If the length of the sampling period is incorrect, adjust the "SAMPLING PERIOD" potentiometer (R527, figure 5-3) on the comparator front panel until the required length is obtained.

5-16. COMPARATOR CM-23/GR SENSITIVITY AND ANTENNA PREFERENCE TEST.

(See figure 5-8.)

5-17. This test is designed to check if antenna No. 2 (the taller antenna) is normally the preferred antenna. This test also checks the sensitivity of Comparator CM-23/GR, which must be such that it selects the antenna having a six-decibel greater output and causes the proper switching action to take place. The sensitivity and antenna preference test requires Antenna Position Simulator SM-26/U, three six-db pads, and a T-connector. The tests and adjustments prescribed in paragraphs 5-10 through 5-15 must be made before performing this test.

5-18. TEST PROCEDURE.

a. Disconnect Target Antenna AT-368/CRD-6 from Radio Transmitter T-216/GR at the transmitter.

b. Connect the T-connector to the "RF OUTPUT" receptacle of the transmitter as shown in figure 5-8.

c. Connect the DF generator output of Antenna Position Simulator SM-26/U to the external modulation jacks of the transmitter.

d. Disconnect the Antenna AS-449/GRD r-f cables from Comparator CM-23/GR.

e. Using short lengths of r-f cable, connect one six-db pad to each arm of the T and the comparator "ANTENNA NO. 1" receptacle (J502, figure 5-3) and the "ANTENNA NO. 2" receptacle (J504). These two pads are used for isolation.

f. Place the "POWER" switches of the transmitter, antenna position simulator, comparator, and Radio Receiver R-278A/GR at "ON."

g. Place the comparator antenna selection switch (S503, figure 5-3) at "AUTOMATIC."

h. Set the circuit breaker type switch (S301, figure 5-5) on Direction Finder Control C-567/GRD at "ON."

i. Allow a five-minute warm-up period.

j. Tune the transmitter and receiver to the same frequency.

k. Adjust the percentage modulation to 60 percent.

l. Set the output level of the transmitter to 5000 microvolts.

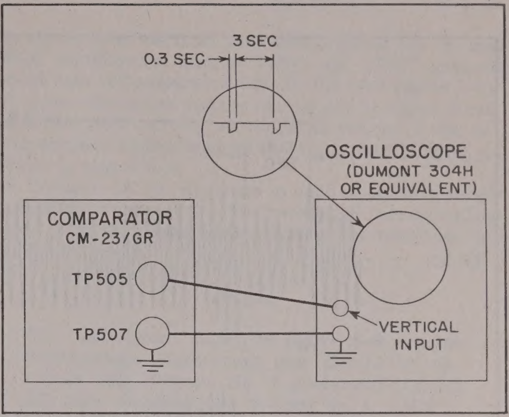


Figure 5-7. Comparator CM-23/GR Sampling Period Test, Test Set-Up

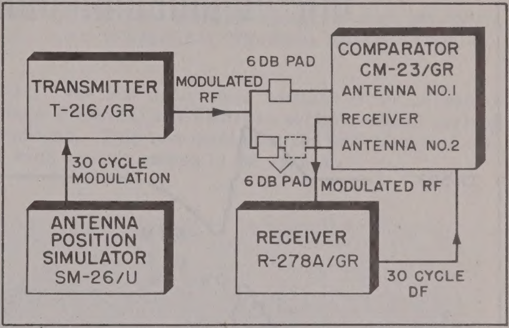


Figure 5-8. Comparator CM-23/GR, Sampling Period, Sensitivity, and Antenna Preference Test, Test Set-Up

m. Antenna No. 2 should now be the operating antenna, indicated by the corresponding comparator lamp (I502, figure 5-3) lighting for three-second intervals.

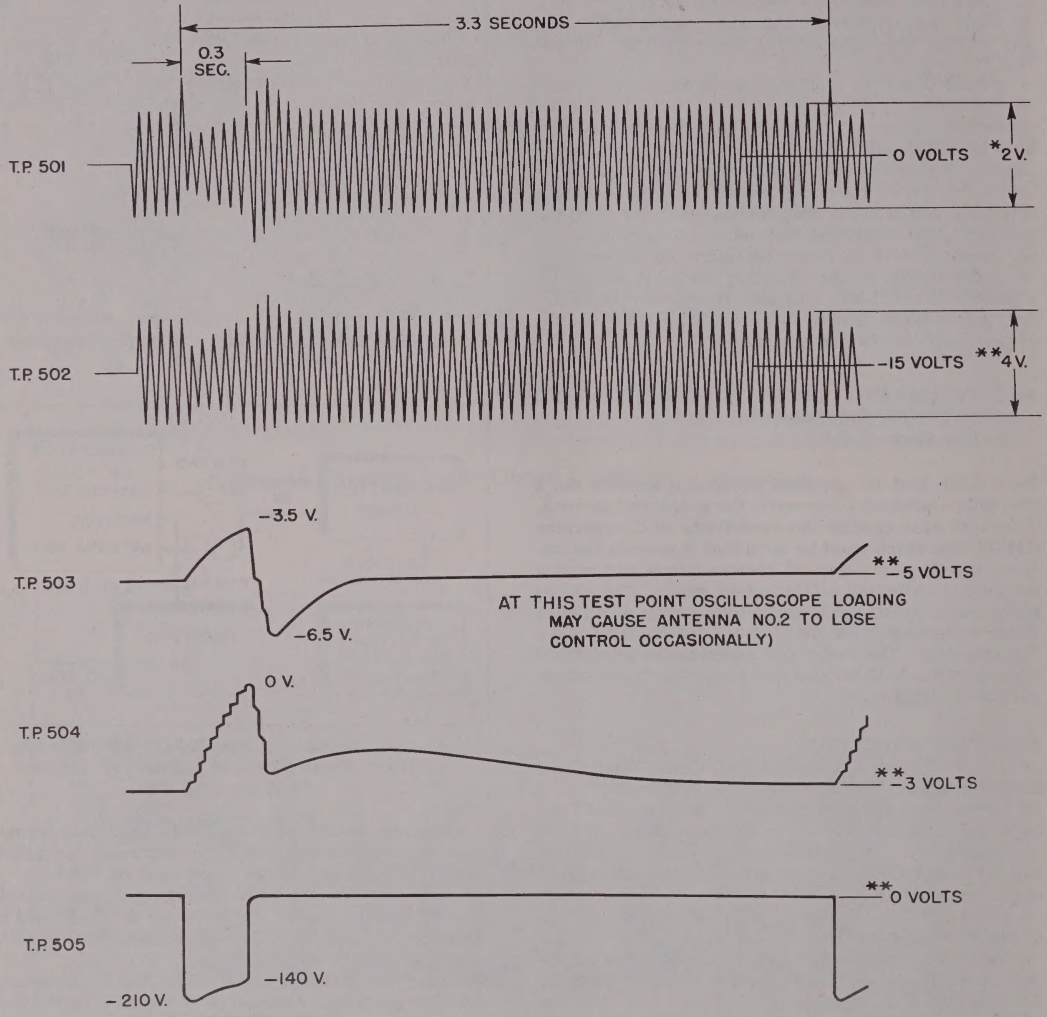
n. If antenna No. 2 is not the operating antenna, position the "POWER" switch of the receiver at "OFF" and adjust the "ANTENNA PREFERENCE" control (R519) in accordance with steps o and p.

o. Turn the "ANTENNA PREFERENCE" control completely clockwise. Antenna No. 2 will now be the sampled antenna and the "ANTENNA NO. 2" neon lamp (I502) will be illuminated for the 0.3-second sampling period.

p. Turn the "ANTENNA PREFERENCE" control slowly counterclockwise in small increments until the "ANTENNA NO. 2" lamp lights for the three-second operating period.

q. If it was necessary to turn off the receiver to adjust the "ANTENNA PREFERENCE" control, turn it on again and repeat step m.

r. Connect another six-db pad (shown in broken-line in figure 5-8) into the line feeding receptacle "ANTENNA NO. 2" (J504, figure 5-3). This causes the antenna No. 2 receptacle to receive a signal six decibels weaker than that received by receptacle "ANTENNA NO. 1" (J502).



* THIS VALUE IS OBTAINED BY ADJUSTING THE PERCENT MODULATION ON TRANSMITTER T-216/GR

** ALL VOLTAGES ARE APPROXIMATE AND ARE MEASURED WITH OSCILLOSCOPE CALIBRATED

NOTES:

1. WAVEFORMS TAKEN WITH DUMONT 304H OSCILLOSCOPE USING D-C COUPLING
2. TARGET TRANSMITTER T-216/GR MODULATED WITH 30 C.P.S.
3. TARGET TRANSMITTER OUTPUT LEVEL SET TO 1,000 MICROVOLTS
4. ANTENNA NO.2 6db STRONGER THAN ANTENNA NO.1

Figure 5-9. Comparator CM-23/GR Test Point Waveforms

s. Place the antenna selector switch at "ANTENNA NO. 2" for 10 seconds.

t. Turn the antenna selector switch back to "AUTOMATIC" in order to permit the comparator to cycle normally.

u. Antenna No. 1 should now be the operating antenna, the "ANTENNA NO. 1" lamp (I501, figure 5-3) lighting for the three-second operating period.

v. If antenna No. 1 does not become the operating antenna, check the storage circuits. (Refer to paragraphs 4-7 through 4-14 and to table 4-3.)

5-19. COMPARATOR CM-23/GR CIRCUIT OPERATION TEST.

5-20. This test is designed to check the various portions of the comparator circuit for correct operation. Correct operation is determined from the waveforms displayed on a long-persistence screen oscilloscope. This test requires a Dumont model 304H oscilloscope in addition to the equipment used for the comparator sensitivity and antenna preference test, paragraph 5-16.

5-21. TEST PROCEDURE.

a. Repeat steps a through j, paragraph 5-18, except that two six-decibel pads must be inserted in the antenna No. 1 branch of the T, thus making antenna No. 2 six decibels stronger.

b. Set the output level of Radio Transmitter T-216/GR to 1000 microvolts.

c. Connect the vertical input terminals of the Dumont 304H oscilloscope across TP501 and TP507 (ground) on the rear of Comparator CM-23/GR (see figure 5-6).

d. Adjust the output voltage of Antenna Position Simulator SM-26/U until the waveform displayed on the oscilloscope is approximately two volts peak to peak, as shown in figure 5-9.

e. Connect the oscilloscope to each of the test points indicated in figure 5-9. The waveform corresponding to the test point should be displayed on the oscilloscope.

NOTE

> The waveforms shown in figure 5-9 are the approximate waveforms that should be obtained with antenna No. 2 preferred and six decibels stronger than antenna No. 1. All voltages shown in figure 5-9 are measured with the oscilloscope, which is calibrated by using a known d-c voltage source.

5-22. DIRECTION FINDER CONTROLS C-567/GRD AND C-568/GRD CONTROL TEST.

5-23. This test determines whether or not Direction Finder Control C-568/GRD can perform all its control functions. This test must be given to the control unit at each remote station in the system.

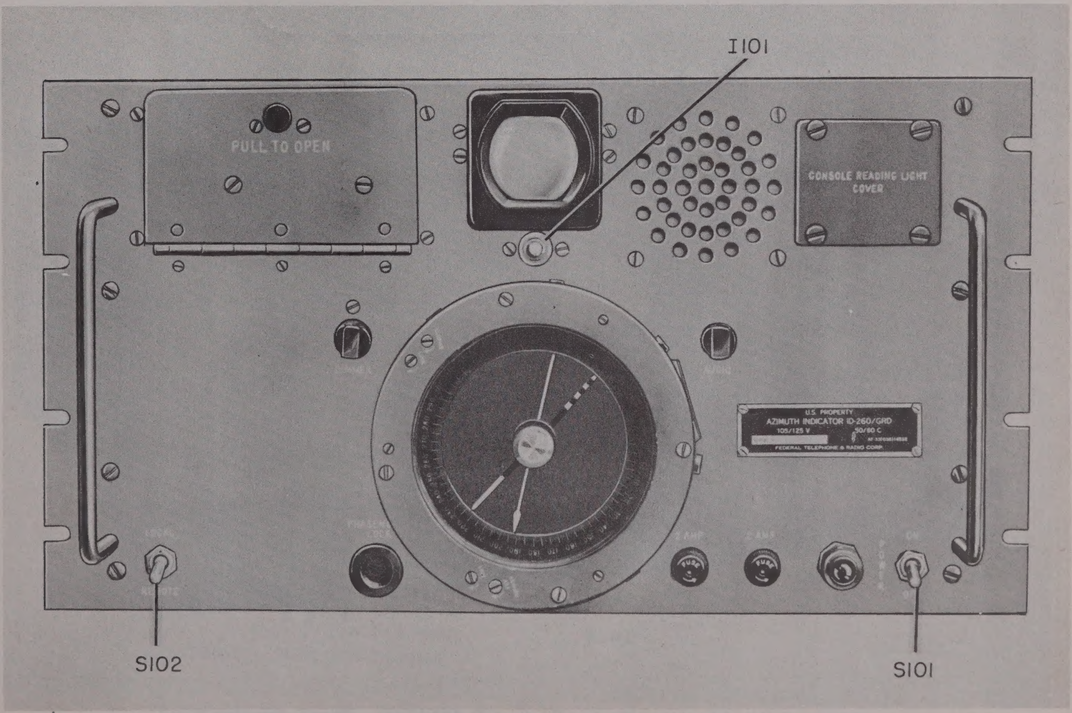

I101
PULL TO OPEN
CONSOLE READING LIGHT COVER
U.S. PROPERTY
AZIMUTH INDICATOR ID-260/GRD
105/125 V
50/60 C
FEDERAL TELEPHONE & RADIO CORP.
S102
S101

Figure 5-10. Azimuth Indicator ID-260/GRD - Front View

5-24. TEST PROCEDURE.

NOTE

In testing a remote control unit, a man must be present at the local station to determine if the remote control unit is properly executing the control functions at the local station.

5-25. AT THE LOCAL STATION.

a. Position the "POWER" switches of all local station components except Azimuth Indicator ID-260/GRD at "ON."

b. Place the azimuth indicator "LOCAL-REMOTE" switch (S102, figure 5-10) at "REMOTE."

c. Place the local control unit "REMOTE-LOCAL" switch (S302, figure 5-5) at "REMOTE."

d. Set the "CHANNEL SELECTOR" switches of Radio Receiver R-278A/GR and Radio Transmitter T-216/GR at "REMOTE."

5-26. AT THE REMOTE STATION.

a. Position the "POWER" switch of Direction Finder Control C-568/GRD, and, if at Station A of a multi-remote installation, of Junction Box J-476/CRD-6, at "ON."

b. Make sure the azimuth indicator "POWER" switch (S101, figure 5-10) is at "OFF."

c. If checking a single-remote installation without Junction Box J-476/CRD-6, place the remote control unit "SINGLE-PARALLEL" switch (S410, figure 5-11) at "SINGLE."

d. If checking a multi-remote installation, place the "SINGLE-PARALLEL" switch on each remote control unit at "PARALLEL."

e. Check plate currents of the remote control unit reference amplifiers by first depressing toggle switch "REF AMP" "1" (S401, figure 5-11) and then "2" (S402). The plate currents of both, as indicated by the "PLATE CURRENT" meter (M401), should be equal. Check for plate-current equality when toggle switch "REF AMP" "3" (S403) and then "4" (S404) are depressed. If necessary, equalize plate currents by setting the "ADJUST" potentiometer (R409) and R423) beneath each set of toggles.

f. If it is not possible to equalize the plate currents by adjusting potentiometers R409 and R423, change tubes V402 and V403 (see figure 4-4) for reference amplifiers 1 and 2, or V405 and V406 for reference amplifiers 3 and 4. If this does not remove the trouble, check potentiometers R409 or R423, as well as the other elements in the reference amplifier circuits.

g. At each remote station in turn, repeatedly depress the "CONTROL" switch (S406, figure 5-11) on the remote control unit until the "CONTROL" indicator lamp (I402, I403, I404, or I405) marked with the corresponding station designation is illuminated.

h. After a remote station has assumed control of the system, as indicated by illumination of its corresponding "CONTROL" lamp, make the following checks at that particular station.

i. Depress one of the buttons on the "CHANNEL FREQUENCY" switch (S408). The local station equipment should be energized within 40 seconds.

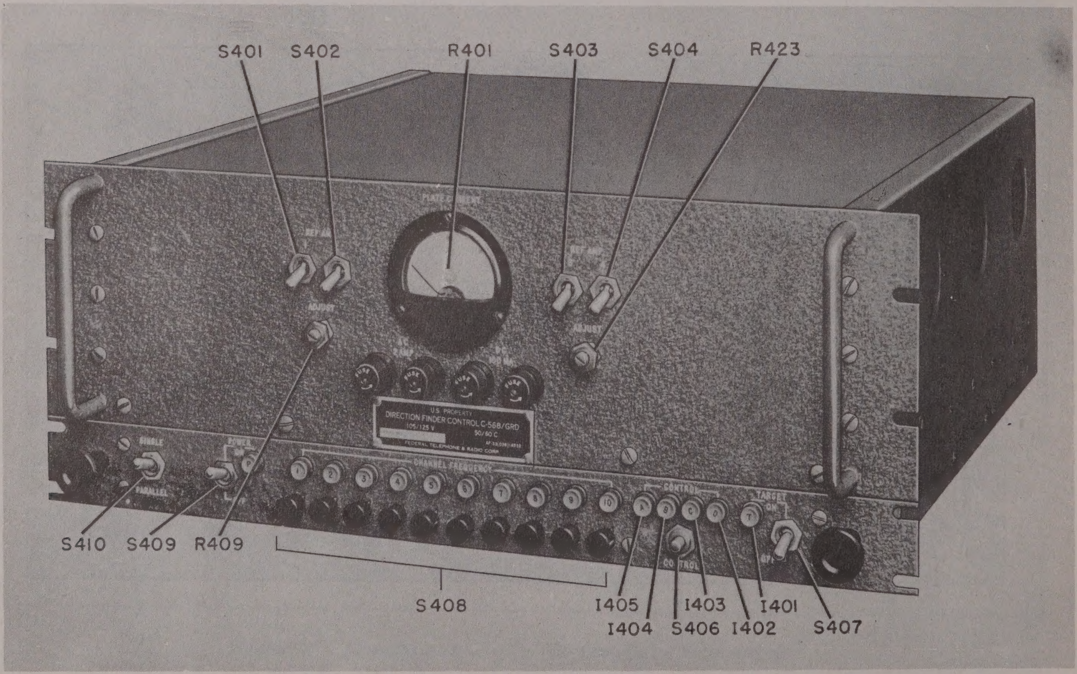


Figure 5-11. Direction Finder Control C-568/GRD - Three-Quarter View

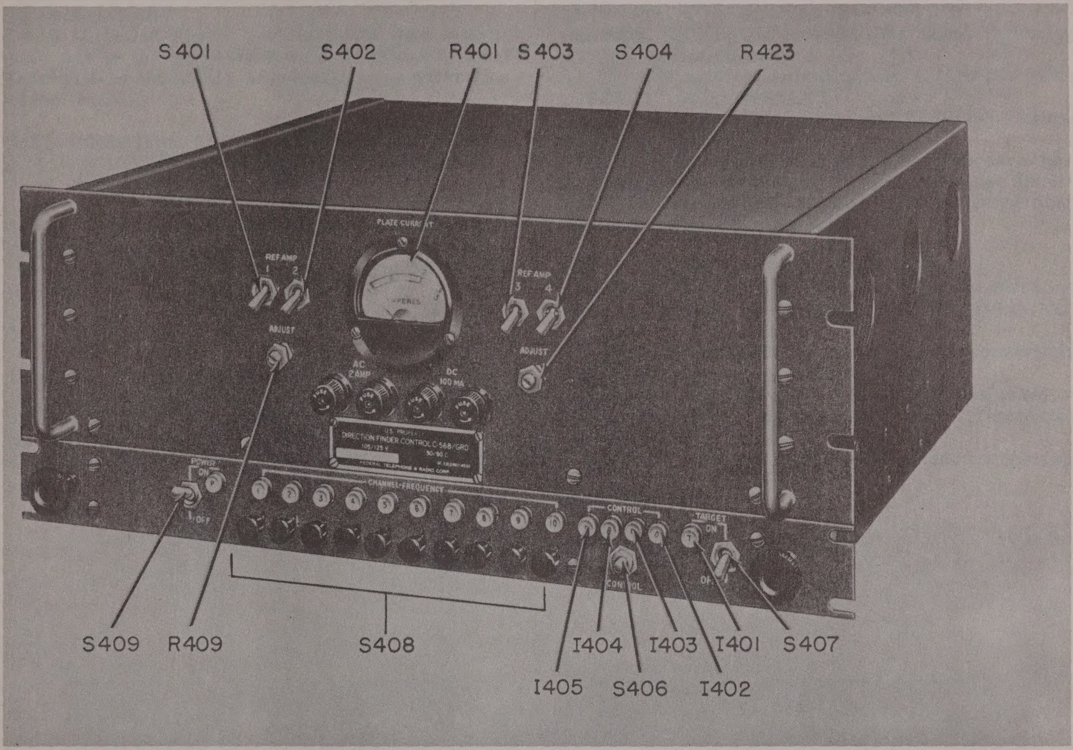


Figure 5-11A. Direction Finder Control C-568/GRD - Three-Quarter View, as manufactured under Air Force Contract No. AF33(038)-30605

j. Release the button depressed in step i. The local station equipment should be turned off.

k. Place the remote control unit "TARGET" switch (S407) at "ON" and then at "OFF." Radio Transmitter T-216/GR at the local station should respond accordingly.

l. Depress each "CHANNEL FREQUENCY" button in turn. Each of the ten preset channels should be properly selected.

m. If Direction Finder Control C-568/GRD fails to pass any of the above tests, refer to paragraphs 4-7 through 4-14 and table 4-3 for location and correction of the trouble.

5-27. DIRECTION FINDER CONTROLS C-567/GRD AND C-568/GRD REFERENCE AMPLIFIER AND DF AMPLIFIER TEST.

5-28. This test checks the gain of the local and remote control unit amplifiers. This test also determines if there are excessive signal losses in the cables connecting the local and remote stations.

5-29. TEST PROCEDURE.

5-30. AT THE REMOTE STATION.

a. If a multi-remote installation, turn Junction Box J-476/CRD-6 "POWER" switch to "ON."

b. Turn the "POWER" switch (S409, figure 5-11) of each remote control unit in the installation to "ON."

c. Make sure the "POWER" switches (S101, figure 5-10) of each Azimuth Indicator ID-260/GRD is at "OFF."

d. If a multi-remote installation, position the "SINGLE-PARALLEL" switch (S410, figure 5-11) of each remote control unit at "PARALLEL." If a single-remote installation, position this switch at "SINGLE."

e. At the remote station being checked, repeatedly depress the "CONTROL" switch (S406) until the corresponding "CONTROL" lamp is illuminated, indicating control by that station.

f. Depress one of the buttons on the "CHANNEL FREQUENCY" switch (S408).

g. Position the remote control unit "TARGET" switch (S407) at "ON."

h. Allow five minutes for the equipment to warm up.

i. Equalize the remote control unit reference amplifier plate currents in accordance with the instructions in paragraph 5-26, steps e and f.

5-31. AT THE LOCAL STATION.

a. Turn Azimuth Indicator ID-260/GRD and Direction Finder Control C-567/GRD "REMOTE-LOCAL" switches to "REMOTE."

b. Position the "POWER" switches of all components except the azimuth indicator at "ON."

c. Place the "CHANNEL SELECTOR" switches of Radio Receiver R-278A/GR and Radio Transmitter T-216/GR at "REMOTE."

d. Turn the Comparator CM-23/GR antenna selector

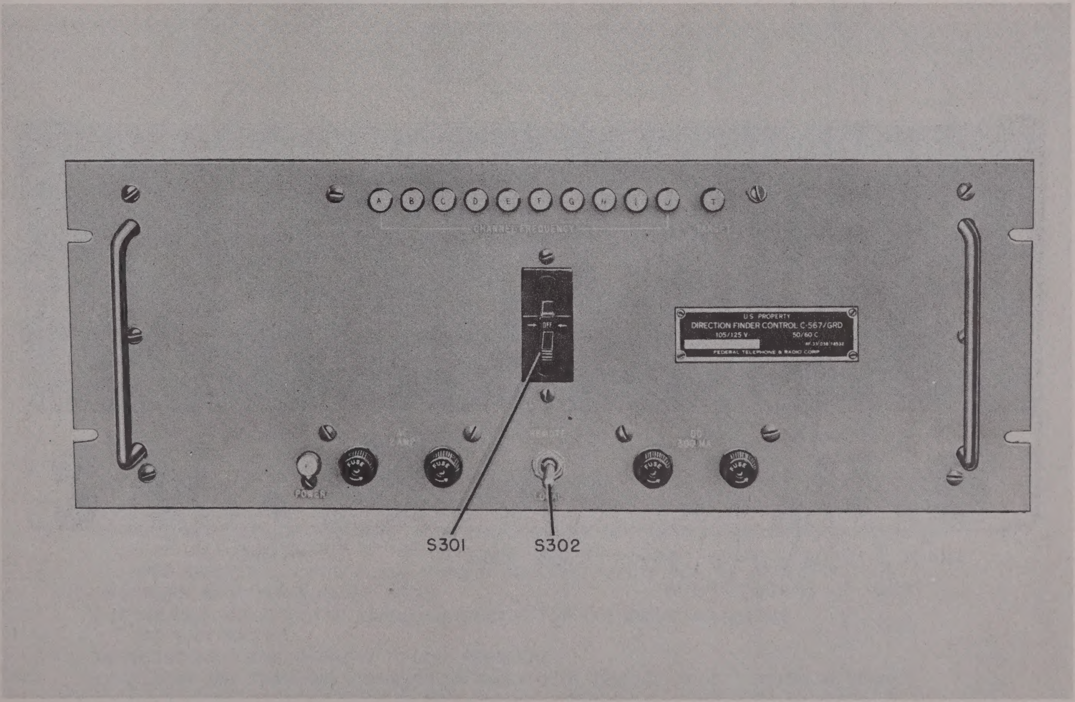


Figure 5-12. Direction Finder Control C-567/GRD - Rear View

switch (S503, figure 5-3) to "ANTENNA NO. 1."

e. Set the receiver "RF GAIN" control to its maximum clockwise setting.

f. Connect an a-c vacuum-tube voltmeter, ME-6/U or equivalent, across TP305 and TP302 (ground) on the rear of the local control unit (see figure 5-12). Use potentiometer R313 to adjust the voltmeter reading to 22.5 volts rms.

g. Connect the voltmeter across TP304 and TP302. The meter should read approximately 4.5 volts rms.

h. If the meter does not read approximately 4.5 volts rms or if the voltage across TP305 and TP302 cannot be adjusted to 22.5 volts rms, refer to paragraphs 4-7 through 4-14 and table 4-3 for location and correction of possible trouble.

i. If the requirements of steps f and g are satisfied, connect the voltmeter across TP301 and TP302.

j. Adjust the transmitter "RF ATTENUATOR" control until the voltmeter reads 1.0 volt rms.

k. Connect the voltmeter across TP303 and TP302. The meter should read approximately five volts rms.

l. If the voltmeter does not read approximately five volts rms, refer to paragraphs 4-7 through 4-14 and table 4-3 for location and correction of possible trouble.

5-32. AT THE REMOTE STATION.

a. Connect a vacuum-tube voltmeter, ME-6/U or equivalent, across TP405 and TP406 (ground) on the rear of the remote control unit (see figure 5-13).

b. Adjust potentiometer R463 until the voltmeter reads 10 volts rms.

c. Connect the voltmeter across TP402 and TP406. The voltmeter should read approximately six volts rms.

d. Connect the voltmeter across TP407 and TP406. The voltmeter should read within plus or minus two percent of the 10-volt reading required in step b.

e. Connect the voltmeter across TP403 and TP406. Adjust potentiometer R462 until the meter reads one volt rms.

f. Connect the voltmeter across TP404 and TP406. The meter should read approximately 13 volts rms.

g. If the requirements of steps e and f are not met, refer to paragraphs 4-7 through 4-12 for location and correction of the trouble.

5-33. AZIMUTH INDICATOR ID-260/GRD CIRCUIT OPERATION TEST.

5-34. This test not only checks operation of the various portions of the azimuth indicator circuit, but also checks the following: At the local station, the reference voltage of Antenna AS-449/GRD is determined at TP101 and TP102 on the azimuth indicator, and the DF output of Radio Receiver R-278A/GR is determined at TP110. (See figure 5-14). At the remote station(s), the reference voltage of Direction Finder Control C-568/GRD is determined at TP101 and TP102 on the remote station azimuth indicator, and the DF output of the remote control unit is determined at TP110. Correct operation is determined from the waveforms displayed on the long-persistence screen of a Dumont model 304H oscilloscope.

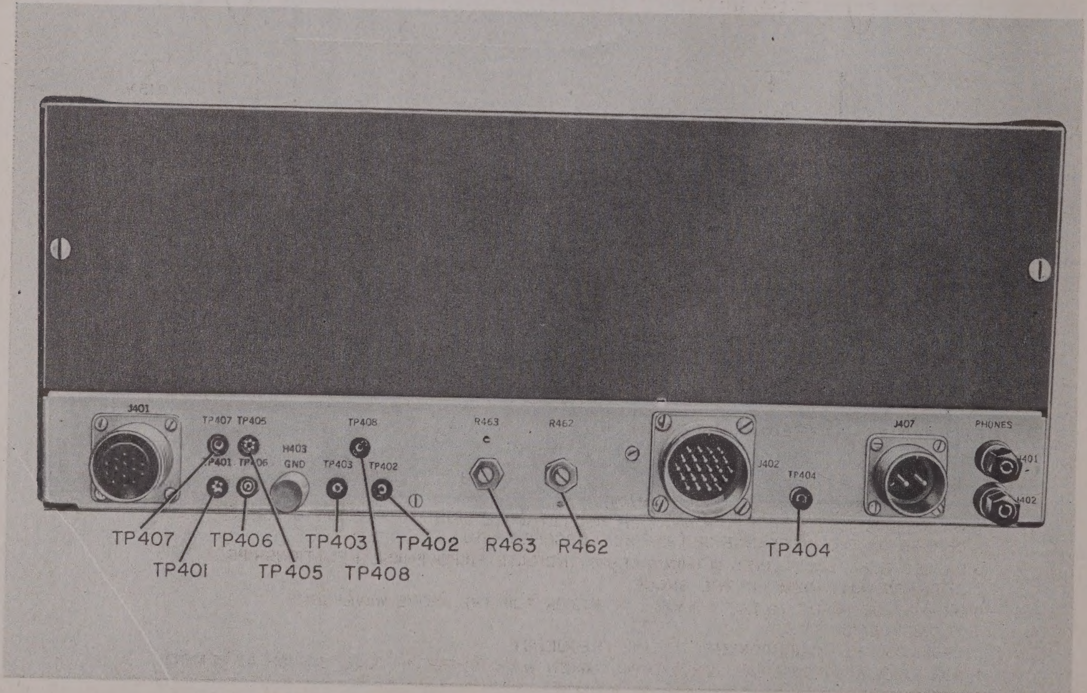


Figure 5-13. Direction Finder Control C-568/GRD - Rear View

NOTE

In figure 5-14, the fixed phase relationships between waveforms are indicated by the vertical broken lines.

5-35. TEST PROCEDURE.

a. Turn on all components at the local station and all those at the remote station to be checked.

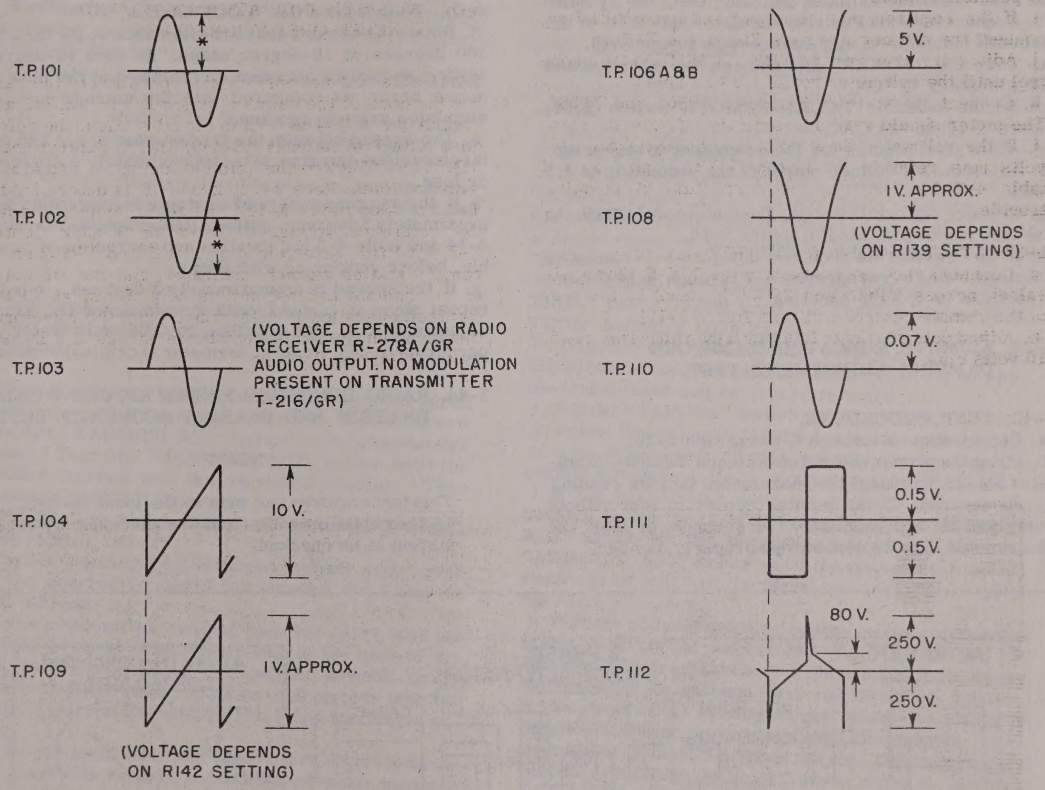
b. Synchronize the Dumont model 303H oscilloscope frequency to the line frequency.

c. Connect the vertical input terminals of the oscilloscope in turn to each of the test points indicated in figure 5-14.

NOTE

The waveforms at TP101 and TP102 are taken with the azimuth indicator "LOCAL-REMOTE" switch (S102, figure 5-10) at "REMOTE." For all other test points, this switch must be at "LOCAL."

d. If the correct waveform is not obtained for each test point, check the circuit to which the particular test point is connected. (Refer to paragraph 4-12.)


T.P 101
*
T.P 102
*
T.P 103
(VOLTAGE DEPENDS ON RADIO RECEIVER R-278A/GR AUDIO OUTPUT. NO MODULATION PRESENT ON TRANSMITTER T-216/GR)
T.P 104
10 V.
T.P 109
1 V. APPROX.
(VOLTAGE DEPENDS ON R142 SETTING)
T.P 106 A & B
5 V.
T.P 108
1 V. APPROX.
(VOLTAGE DEPENDS ON R139 SETTING)
T.P 110
0.07 V.
T.P 111
0.15 V.
0.15 V.
T.P 112
80 V.
250 V.
250 V.

* THIS VOLTAGE IS APPROXIMATELY 20 VOLTS

NOTES:

1. ALL VOLTAGES SHOWN ARE APPROXIMATE.
2. WAVEFORMS TAKEN WITH DUMONT 304H OSCILLOSCOPE USING A-C COUPLING. VOLTAGE VALUES DEPEND ON THE IMPEDANCE OF THE OSCILLOSCOPE USED.
3. DASHED REFERENCE LINES WITHIN A GROUP INDICATE FIXED PHASE RELATIONSHIPS BETWEEN WAVEFORMS IN THE GROUP.
4. DF VOLTAGE INPUT TO THE AZIMUTH INDICATOR FOR THE ABOVE WAVEFORMS IS ONE VOLT 30 C.P.S.
5. OSCILLOSCOPE SYNCHRONIZED TO LINE FREQUENCY.
6. FOR TP101 AND TP102 ONLY, WAVEFORMS TAKEN WITH "REMOTE-LOCAL" SWITCH AT "REMOTE".

Figure 5-14. Azimuth Indicator ID-260/GRD Test Point Waveforms

5-36. AZIMUTH INDICATOR ID-260/GRD BENCH TEST.

5-37. This test is designed to check the various portions of the azimuth indicator circuit for correct operation, which is determined from waveforms displayed on an oscilloscope with a long-persistence screen. Before the test is made, the oscilloscope should be calibrated to check amplitude of the waveforms displayed. The fixed phase relationships between waveforms are indicated in figure 5-14 by the vertical broken lines.

5-38. TEST PROCEDURE.

a. Disconnect the azimuth indicator from the system.
b. Connect Antenna Position Simulator SM-26/U to the azimuth indicator in accordance with figure 5-15.
c. Turn the "POWER" switches on the indicator and the simulator to "ON."
d. Set the indicator "LOCAL-REMOTE" switch (S102, figure 5-10) to "LOCAL."
e. Allow five minutes for the equipment to warm up.
f. Adjust the DF voltage output of the simulator to 1.2 volts.
g. Connect an oscilloscope, Dumont model 304H, to the test points indicated in figure 5-14.
h. If the waveforms required in figure 5-14 cannot be obtained, refer to paragraphs 4-7 through 4-14 for instructions on trouble shooting.

5-39. AZIMUTH INDICATOR ID-260/GRD DAMPING ADJUSTMENT TEST.

5-40. TEST PROCEDURE.

a. Repeat steps a through f, paragraph 5-38.
b. Using the proper control on Antenna Position Simulator SM-26/U, change the phasemeter pointer reading by 90 degrees. If the pointer comes to rest without overshoot in approximately two seconds, or less, the phasemeter may be considered properly damped.

5-41. AZIMUTH INDICATOR ID-260/GRD ACCURACY TEST.

5-42. This test is designed to test the bearing accuracy of the azimuth indicator.

5-43. TEST PROCEDURE.

a. Repeat steps a through f, paragraph 5-38.
b. Set the antenna position simulator azimuth scale to zero.
c. Use the damping adjustment screwdriver (located on the inside of the door marked "PULL TO OPEN") to loosen the "LOCK" screw below the "AZIMUTH ADJ" screw on the phasemeter housing. Turn the "AZIMUTH ADJ" screw until the phasemeter pointer indicates zero. Then tighten the "LOCK" screw.
d. Rotate the antenna position simulator scale through 360 degrees in 10-degree steps. At each 10-degree setting, record the phasemeter reading and the plus or minus error, as compared with the antenna position simulator azimuth reading.
e. The spread between the largest plus error and the largest minus error must be approximately 3 degrees, or less.
f. If the maximum spread in step e is more than approximately 3 degrees, refer to paragraphs 4-7 through 4-14 and table 4-3 for location and correction of trouble, before continuing with step g.
g. If the spread is approximately 3 degrees, or less, repeat steps d, e, and f, with the simulator DF output adjusted to 0.4 volt and then to 0.04 volt (refer to paragraph 5-38). Reset phasemeter at original reading.

5-44. RADIO DIRECTION FINDER AN/CRD-6 CALIBRATION AND BEARING ACCURACY TEST.

NOTE

This test requires one man at the local station, another at the antennas, and one at each remote station to be checked.

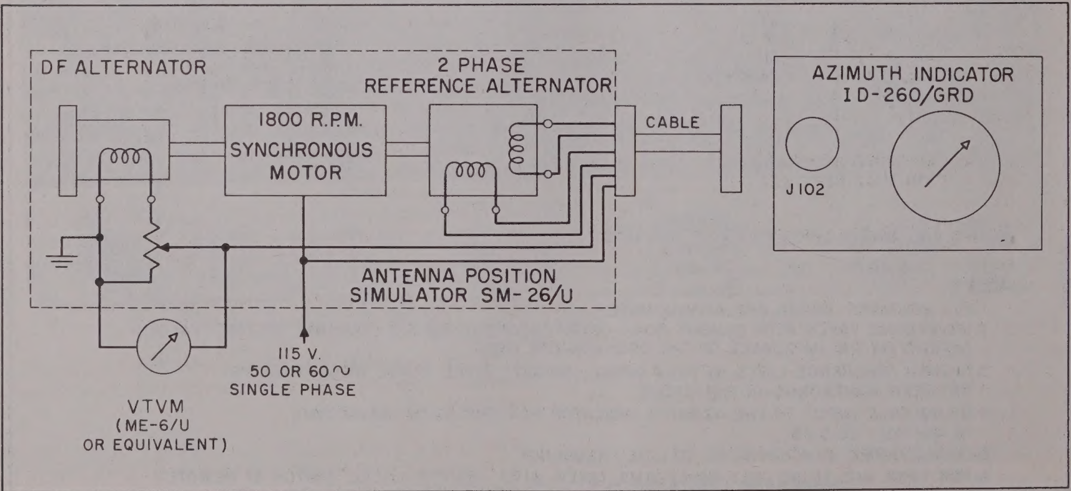

DF ALTERNATOR
2 PHASE REFERENCE ALTERNATOR
1800 R.P.M. SYNCHRONOUS MOTOR
CABLE
AZIMUTH INDICATOR ID-260/GRD
J102
ANTENNA POSITION SIMULATOR SM-26/U
115 V. 50 OR 60 ~ SINGLE PHASE
VTVM (ME-6/U OR EQUIVALENT)

Figure 5-15. Azimuth Indicator ID-260/GRD and Antenna Position Simulator SM-26/U - Block Diagram

5-45. TEST PROCEDURE.

NOTE

> If Azimuth Indicator ID-260/GRD was disconnected from the system in order to perform any of the tests prescribed in the preceding paragraphs, make sure it is reconnected before making this test.

5-46. AT THE LOCAL STATION.

a. Turn the "POWER" switches of all local station components, including Radio Transmitter T-216/GR, to "ON."

b. Position the "REMOTE-LOCAL" switches of Direction Finder Control C-567/GRD and Azimuth Indicator ID-260/GRD at "LOCAL."

c. Tune the transmitter and Radio Receiver R-278A/GR to the same frequency.

d. Allow five minutes for the equipment to warm up.

e. Turn the antenna selector switch (S503, figure 5-3) of Comparator CM-23/GR to "ANTENNA NO. 1."

f. The bearing displayed by the phasemeter must coincide with the bearing recorded for antenna No. 1 and Target Antenna AT-368/CRD-6.

NOTE

> Take a phasemeter bearing reading only when the neon indicator lamp (I101, figure 5-10) is lighted.

g. If the phasemeter bearing indication does not agree with the recorded bearing, loosen the "LOCK" screw below the "AZIMUTH ADJ" screw on the phasemeter housing. Turn the "AZIMUTH ADJ" screw until the indication agrees with the recorded bearing. Then tighten the "LOCK" screw.

h. Position the comparator antenna selector switch at "ANTENNA NO. 2."

i. The bearing displayed by the phasemeter must agree with the bearing recorded for antenna No. 2 and the target antenna.

j. If the phasemeter reading does not agree with the recorded bearing, loosen the clamp at the base of antenna No. 2 mast. Using the spanner wrench, rotate the mast until the phasemeter reading agrees with the bearing recorded for antenna No. 2 and the target antenna.

k. Note the position of the index mark on the antenna No. 2 mast with respect to the azimuth scale mounted on the mast base.

l. Rotate antenna No. 2 mast through 360 degrees in 10-degree steps. At each 10-degree setting, record the phasemeter reading and the plus or minus error, as compared with the mast base azimuth scale reading. The spread between the largest plus error and the largest minus error for full 360-degree rotation must be less than approximately six degrees.

m. If the maximum bearing variation is greater than approximately six degrees, locate and correct the trouble as outlined in paragraphs 4-7 through 4-14 and table 4-3.

n. If phasemeter indications meet the requirements of step l, untwist the antenna cables by rotating the mast 360 degrees in the direction opposite to that used in step l.

o. Check the phasemeter to make sure it reads the bearing recorded for antenna No. 2 and the target antenna.

p. Secure the clamp at the base of antenna No. 2 mast.

q. Position the comparator antenna selector switch at "ANTENNA NO. 1."

r. Repeat steps k through p with antenna No. 1.

s. If any remote stations are to be checked, position the "CHANNEL SELECTOR" switches on the transmitter and receiver at "REMOTE," and "REMOTE-LOCAL" switches on the local control unit and azimuth indicator at "REMOTE." Also make sure the comparator antenna selector switch is positioned at "ANTENNA NO. 1."

5-47. AT THE REMOTE STATION.

a. Place the "POWER" switches of Direction Finder Control C-568/GRD and Azimuth Indicator ID-260/GRD at "ON."

b. Set the "LOCAL-REMOTE" switch (S102, figure 5-10) on the azimuth indicator to "LOCAL."

c. If checking a multi-remote installation, place the "SINGLE-PARALLEL" switch (S410, figure 5-11) on the remote control unit at "PARALLEL." If checking a single-remote installation, place this switch at "SINGLE."

d. Repeatedly depress the remote control unit "CONTROL" button (S406) until the corresponding "CONTROL" indicator lamp lights.

e. Depress the "CHANNEL FREQUENCY" switch (S408) button that corresponds to the frequency to which the transmitter and receiver are tuned.

f. Set the "TARGET" switch (S407) at "ON."

g. Allow five minutes for the equipment to warm up.

h. The phasemeter should indicate the bearing recorded for antenna No. 1 and the target antenna.

i. If the phasemeter does not indicate the recorded bearing, loosen the "LOCK" screw below the "AZIMUTH ADJ" screw on the phasemeter housing. Turn the "AZIMUTH ADJ" screw until the phasemeter indications agree with the recorded bearing. Then tighten the "LOCK" screw.

j. With the antenna selector switch on the comparator at the local station positioned at "ANTENNA NO. 2," the remote station phasemeter must indicate the bearing recorded for antenna No. 2 and the target antenna. If the phasemeter reading is not within one degree of the recorded bearing, do not attempt to adjust the reading with the "AZIMUTH ADJ" screw. Locate and correct the trouble as outlined in paragraphs 4-7 through 4-12 and table 4-3.

k. If the phasemeter reading is within one degree of the bearing recorded for antenna No. 2 and the target antenna, repeat steps k through p, paragraph 5-46.

5-48. RADIO DIRECTION FINDER AN/CRD-6 SENSITIVITY TEST.

5-49. This test checks the r-f sensitivity of Radio Direction Finder AN/CRD-6. It must be performed from the local station.

5-50. TEST PROCEDURE.

a. Position the "POWER" switches of all local station components at "ON."

b. Set the "REMOTE-LOCAL" switches on Direction Finder Control C-567/GRD and Azimuth Indicator

ID-260/GRD at "LOCAL."

c. Tune Radio Receiver R-278A/GR and Radio Transmitter T-216/GR to the same frequency.

d. Set up a field strength meter at antenna No. 1 and tune it to receive the frequency to which the receiver and transmitter are set.

e. Allow five minutes for the equipment to warm up.

f. Adjust the output of the transmitter with the "RF ATTENUATOR" control until the field strength meter reads 20 microvolts per meter.

g. Record both the setting of the transmitter "RF ATTENUATOR" control and the frequency so that this test may be repeated without requiring the use of the field strength meter.

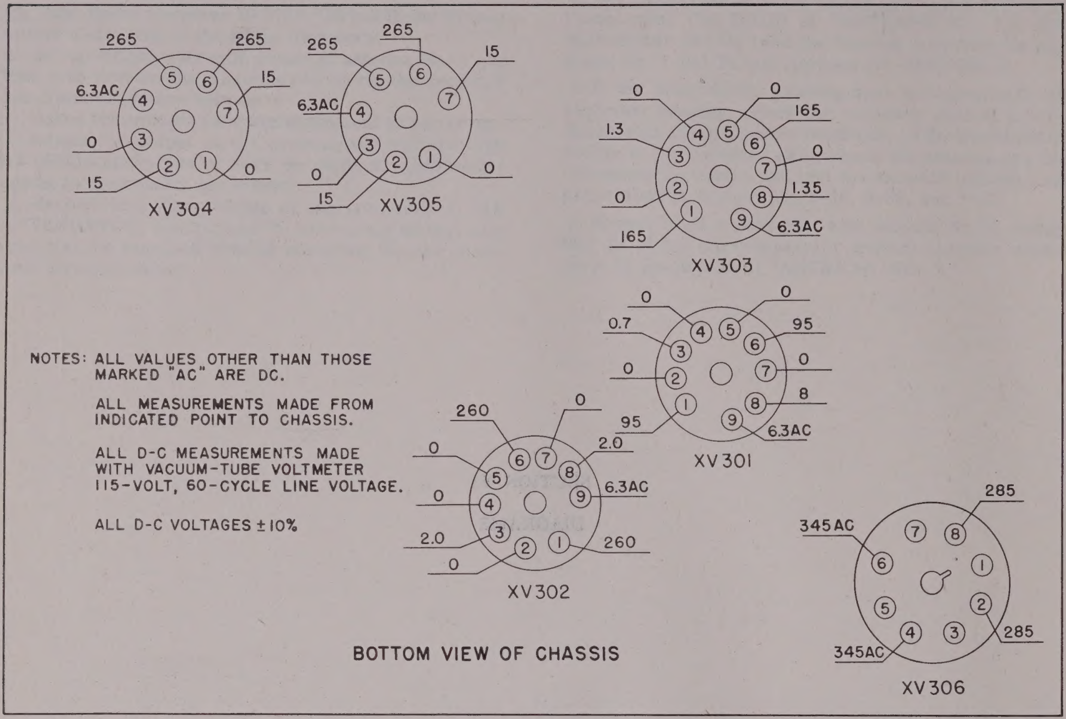
h. Set the antenna selector switch (S503, figure 5-3) of Comparator CM-23/GR at "ANTENNA NO. 1." The phasemeter should read the bearing recorded for antenna No. 1 and Target Antenna AT-368/CRD-6.

i. If the phasemeter reading does not agree with the recorded bearing, check the receiver gain in accordance with the applicable handbook. If the trouble does not lie in the receiver gain, check the antenna and interconnecting cables and test the azimuth indicator as prescribed in paragraphs 5-36, 5-38, and 5-41.

j. Repeat steps d through i with antenna No. 2, noting that in step h the comparator antenna selector switch must be positioned at "ANTENNA NO. 2."

SECTION VI

DIAGRAMS



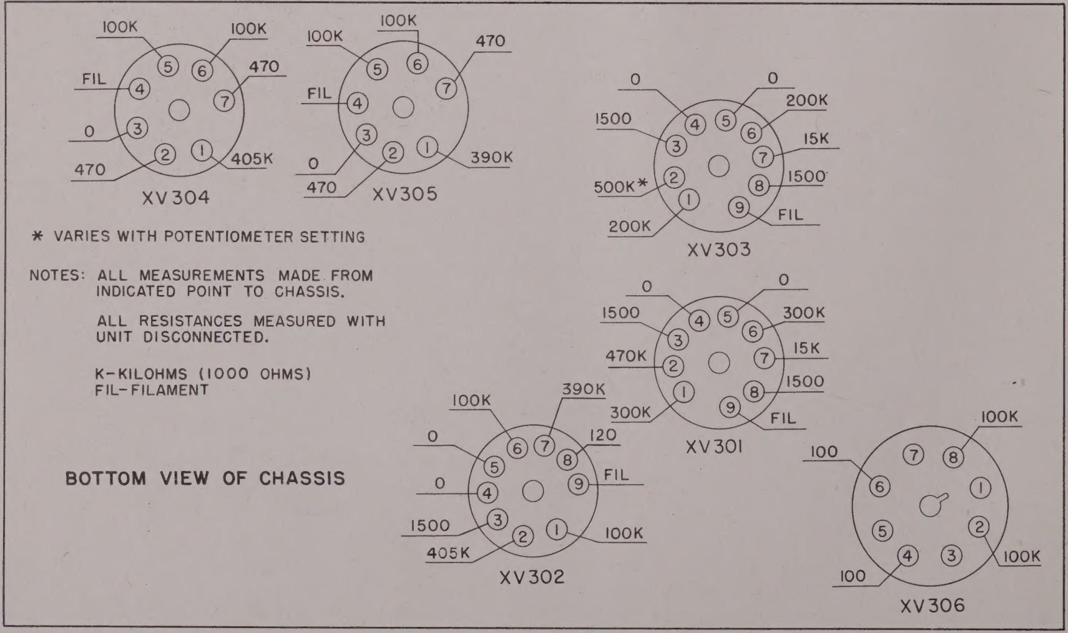
NOTES: ALL VALUES OTHER THAN THOSE MARKED "AC" ARE DC.

ALL MEASUREMENTS MADE FROM INDICATED POINT TO CHASSIS.

ALL D-C MEASUREMENTS MADE WITH VACUUM-TUBE VOLTMETER 115-VOLT, 60-CYCLE LINE VOLTAGE.

ALL D-C VOLTAGES ±10%

Figure 6-1. Direction Finder Control C-567/GRD, Terminal Voltage Diagram



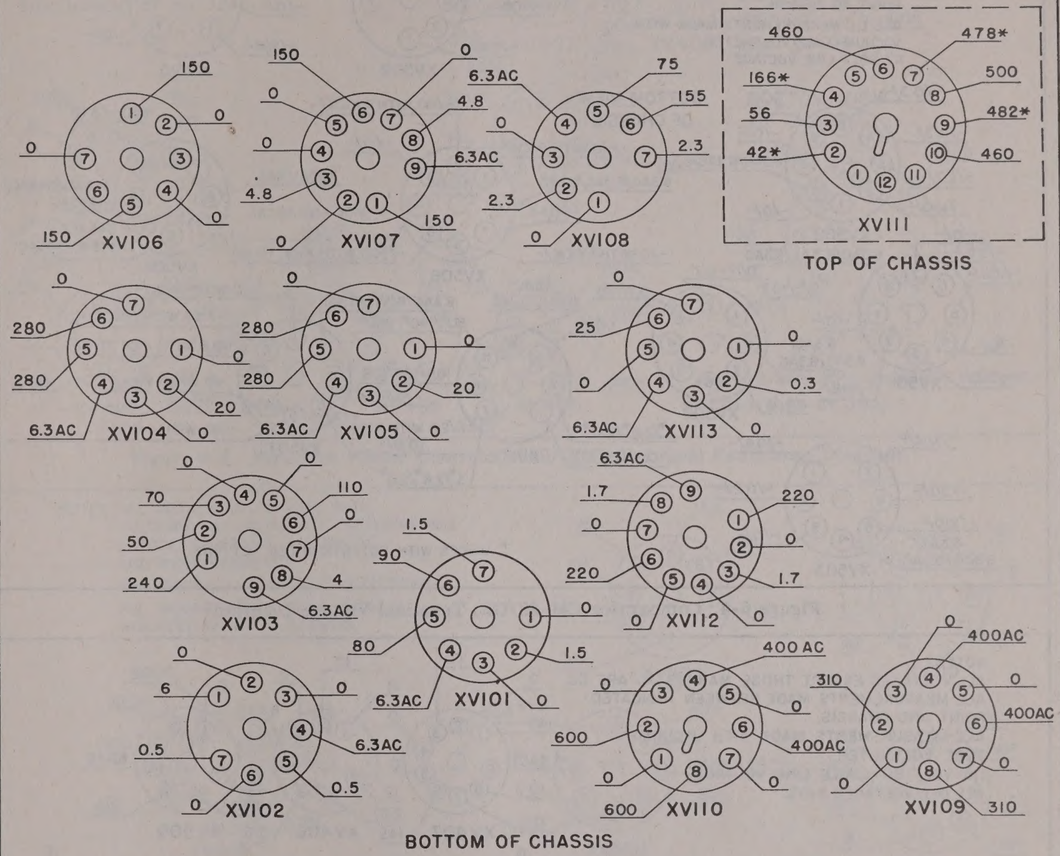
* VARIES WITH POTENTIOMETER SETTING

NOTES: ALL MEASUREMENTS MADE FROM INDICATED POINT TO CHASSIS.

ALL RESISTANCES MEASURED WITH UNIT DISCONNECTED.

K-KILOHMS (1000 OHMS)
FIL-FILAMENT

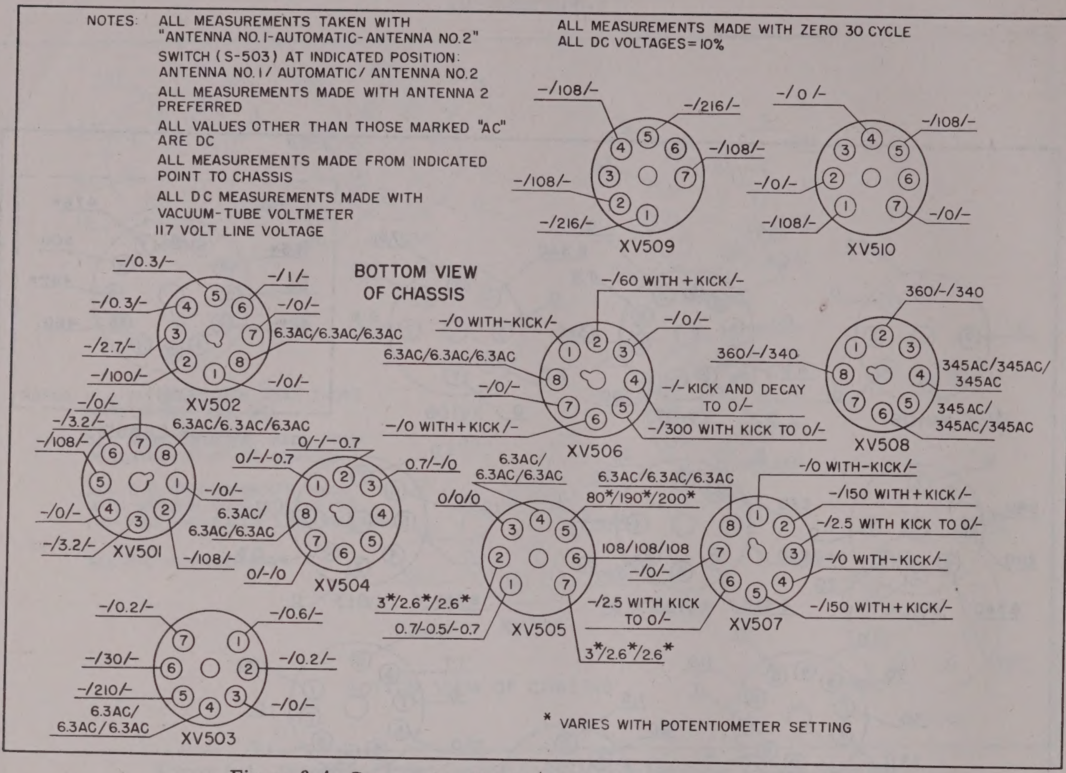
Figure 6-2. Direction Finder Control C-567/GRD, Terminal Resistance Diagram



*DEPENDENT ON SETTING OF PARTICULAR POTENTIOMETER. THESE ARE APPROXIMATE VOLTAGES FOR CORRECT POSITIONING, FOCUSING, ETC.

NOTES: ALL VALUES OTHER THAN THOSE MARKED "AC" ARE DC.
ALL MEASUREMENTS MADE FROM INDICATED POINT TO CHASSIS.
ALL D-C MEASUREMENTS MADE WITH VACUUM-TUBE VOLTMETER.
115-VOLT, 60-CYCLE LINE VOLTAGE.
ALL D-C VOLTAGES ±10%
MEASUREMENTS MADE WITH ZERO 30 CYCLE INPUT

Figure 6-3. Azimuth Indicator ID-260/GRD, Terminal Voltage Diagram



NOTES: ALL MEASUREMENTS TAKEN WITH "ANTENNA NO.1-AUTOMATIC-ANTENNA NO.2" SWITCH (S-503) AT INDICATED POSITION: ANTENNA NO.1/ AUTOMATIC/ ANTENNA NO.2

ALL MEASUREMENTS MADE WITH ANTENNA 2 PREFERRED

ALL VALUES OTHER THAN THOSE MARKED "AC" ARE DC

ALL MEASUREMENTS MADE FROM INDICATED POINT TO CHASSIS

ALL DC MEASUREMENTS MADE WITH VACUUM-TUBE VOLTMETER

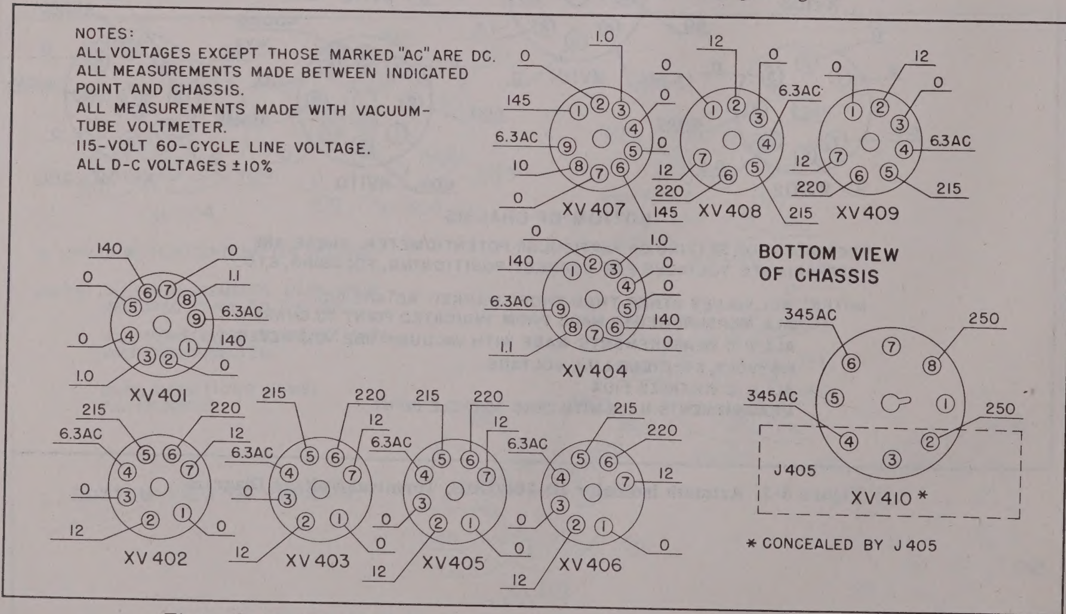
117 VOLT LINE VOLTAGE

ALL MEASUREMENTS MADE WITH ZERO 30 CYCLE

ALL DC VOLTAGES=10%

* VARIES WITH POTENTIOMETER SETTING

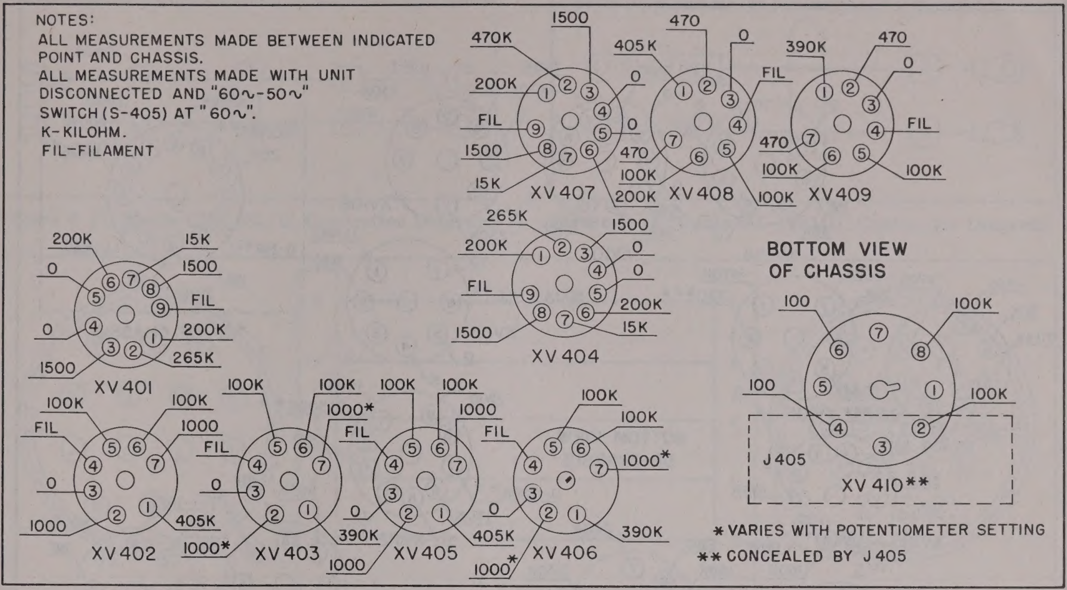
Figure 6-4. Comparator CM-23/GR, Terminal Voltage Diagram



NOTES:
ALL VOLTAGES EXCEPT THOSE MARKED "AC" ARE DC.
ALL MEASUREMENTS MADE BETWEEN INDICATED POINT AND CHASSIS.
ALL MEASUREMENTS MADE WITH VACUUM-TUBE VOLTMETER.
115-VOLT 60-CYCLE LINE VOLTAGE.
ALL D-C VOLTAGES ±10%

* CONCEALED BY J405

Figure 6-5. Direction Finder Control C-568/GRD, Terminal Voltage Diagram

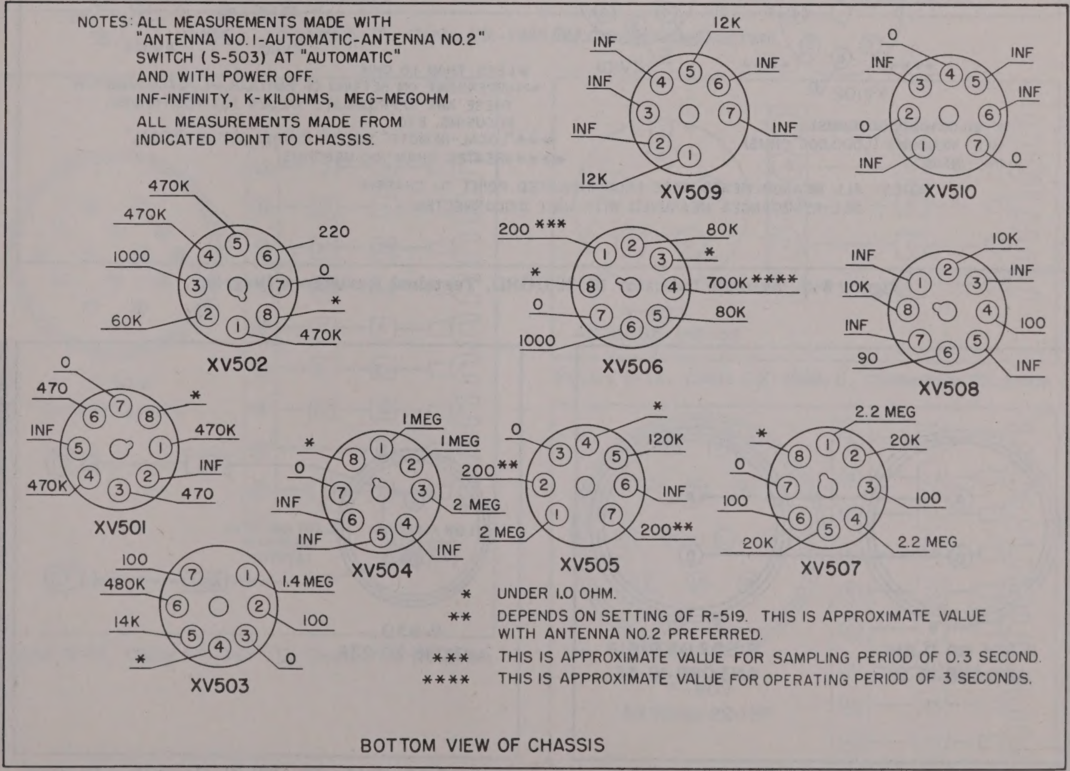


NOTES:
ALL MEASUREMENTS MADE BETWEEN INDICATED POINT AND CHASSIS.
ALL MEASUREMENTS MADE WITH UNIT DISCONNECTED AND "60∿-50∿" SWITCH (S-405) AT "60∿".
K-KILOHM.
FIL-FILAMENT

* VARIES WITH POTENTIOMETER SETTING

** CONCEALED BY J 405

Figure 6-6. Direction Finder Control C-568/GRD, Terminal Resistance Diagram



NOTES: ALL MEASUREMENTS MADE WITH "ANTENNA NO. 1-AUTOMATIC-ANTENNA NO.2" SWITCH (S-503) AT "AUTOMATIC" AND WITH POWER OFF.
INF-INFINITY, K-KILOHMS, MEG-MEGOHM
ALL MEASUREMENTS MADE FROM INDICATED POINT TO CHASSIS.

* UNDER 1.0 OHM.

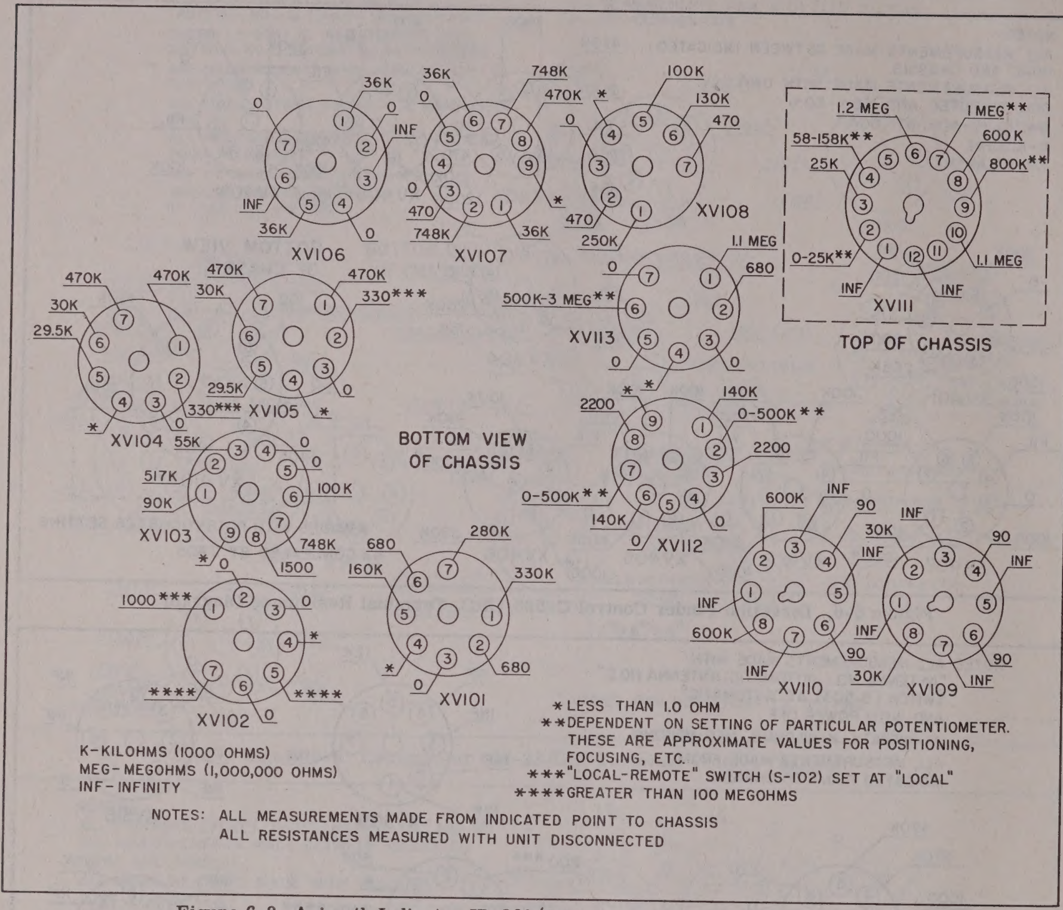
** DEPENDS ON SETTING OF R-519. THIS IS APPROXIMATE VALUE WITH ANTENNA NO.2 PREFERRED.

*** THIS IS APPROXIMATE VALUE FOR SAMPLING PERIOD OF 0.3 SECOND.

**** THIS IS APPROXIMATE VALUE FOR OPERATING PERIOD OF 3 SECONDS.

BOTTOM VIEW OF CHASSIS

Figure 6-7. Comparator CM-23/GR, Terminal Resistance Diagram



K-KILOHMS (1000 OHMS)
MEG-MEGOHMS (1,000,000 OHMS)
INF-INFINITY

* LESS THAN 1.0 OHM
** DEPENDENT ON SETTING OF PARTICULAR POTENTIOMETER. THESE ARE APPROXIMATE VALUES FOR POSITIONING, FOCUSING, ETC.
*** "LOCAL-REMOTE" SWITCH (S-102) SET AT "LOCAL"
**** GREATER THAN 100 MEGOHMS

NOTES: ALL MEASUREMENTS MADE FROM INDICATED POINT TO CHASSIS
ALL RESISTANCES MEASURED WITH UNIT DISCONNECTED

Figure 6-8. Azimuth Indicator ID-260/GRD, Terminal Resistance Diagram

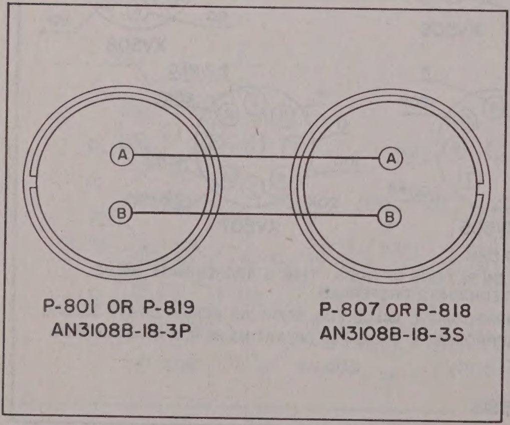


Figure 6-9. Cable CX-1980/U, Connection Diagram

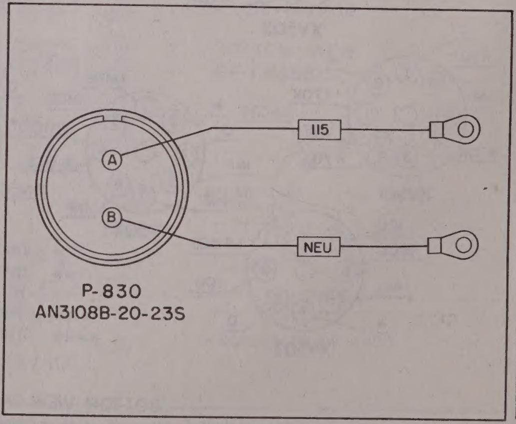


Figure 6-10. Cable CX-1981/U, Connection Diagram

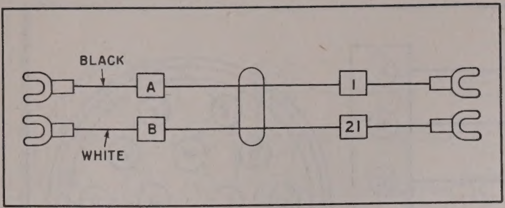


Figure 6-11. Cable CX-1982/U, Connection Diagram

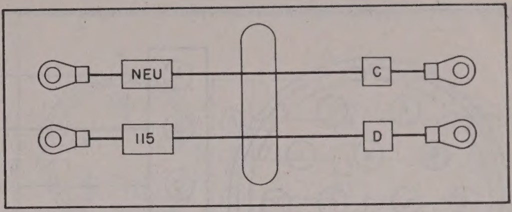


Figure 6-12. Cable CX-1983/U, Connection Diagram

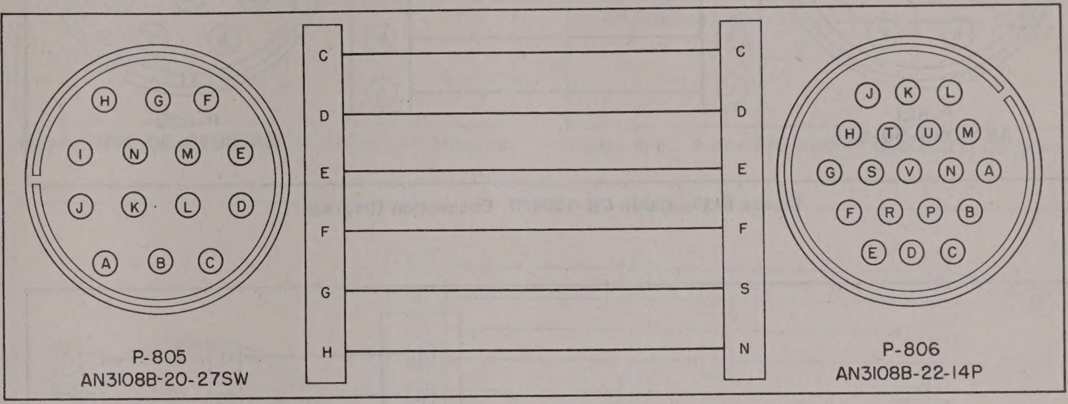


Figure 6-13. Cable CX-1986/U, Connection Diagram

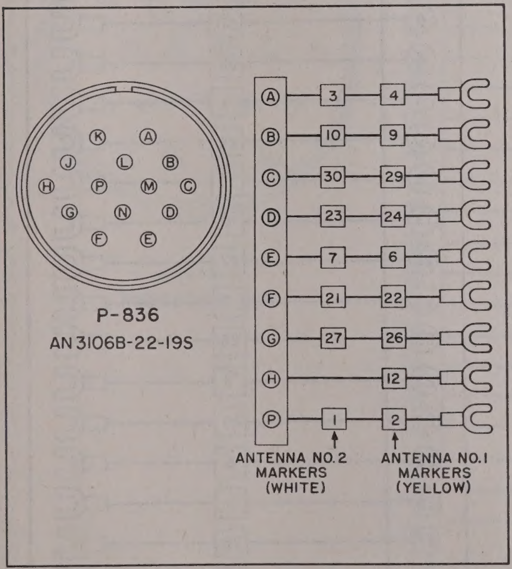


Figure 6-14. Cable CX-1987/U, Connection Diagram

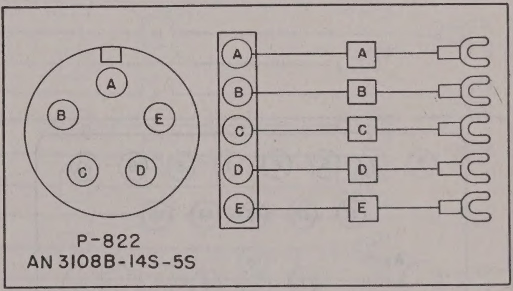


Figure 6-15. Cable CX-1988/U, Connection Diagram

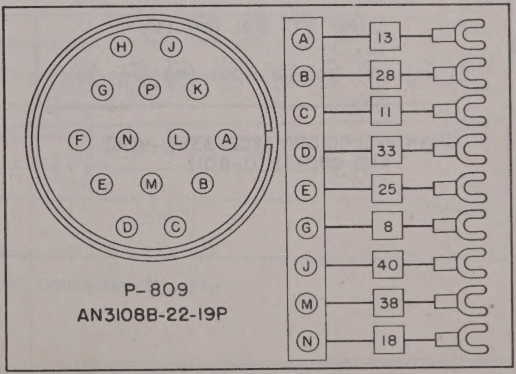


Figure 6-16. Cable CX-1989/U, Connection Diagram

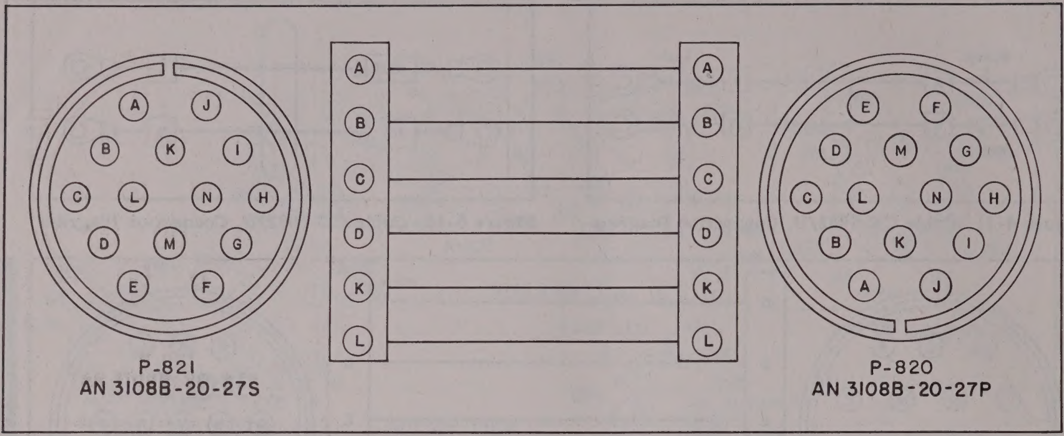


Figure 6-17. Cable CX-1990/U, Connection Diagram

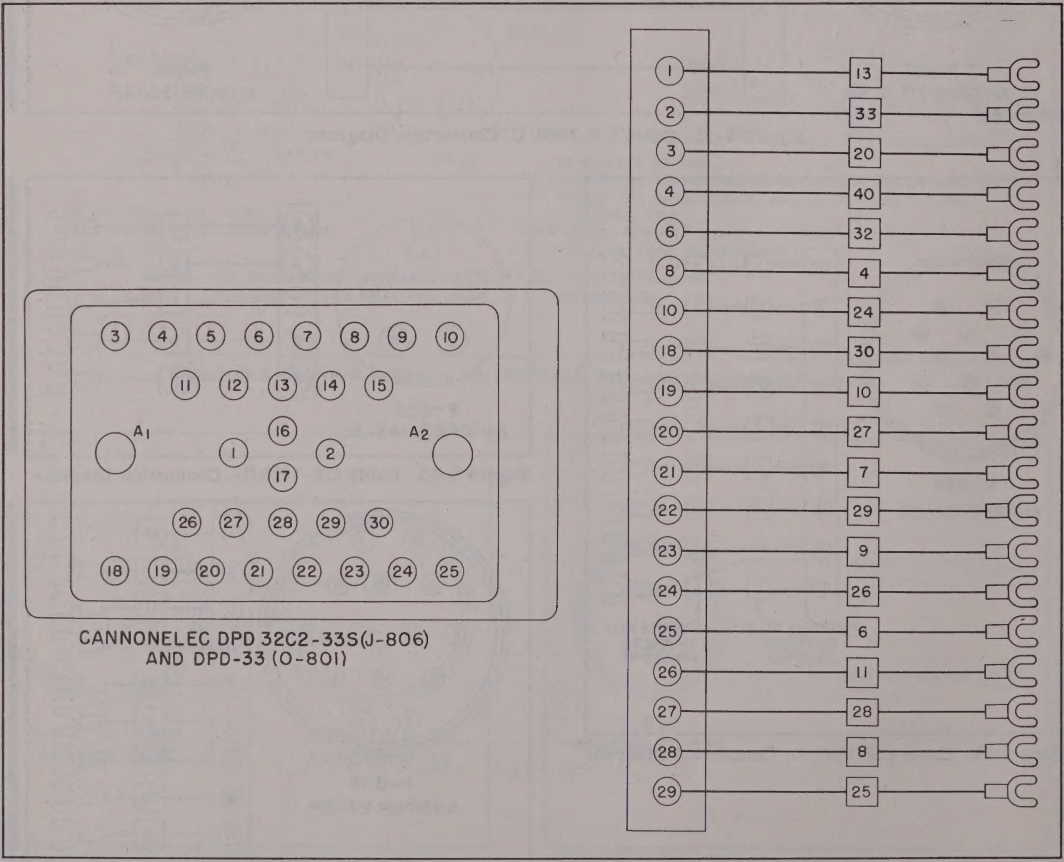


Figure 6-18. Cable CX-1991/U, Connection Diagram

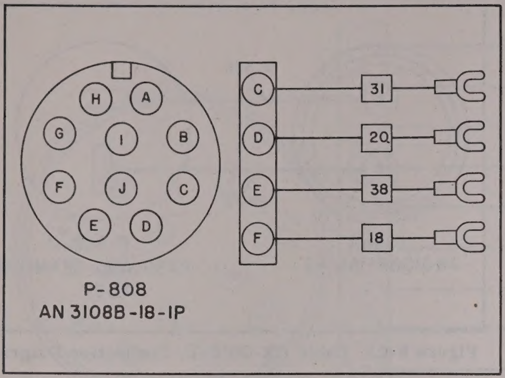


Figure 6-19. Cable CX-1992/U, Connection Diagram

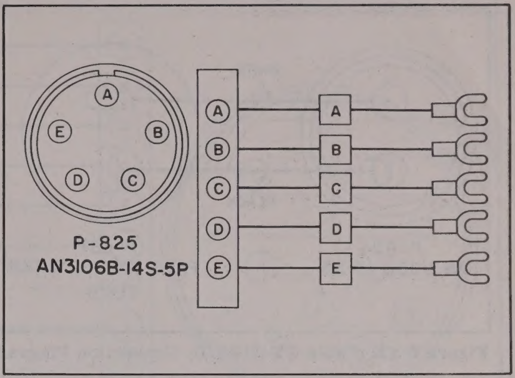


Figure 6-20. Cable CX-2006/U, Connection Diagram

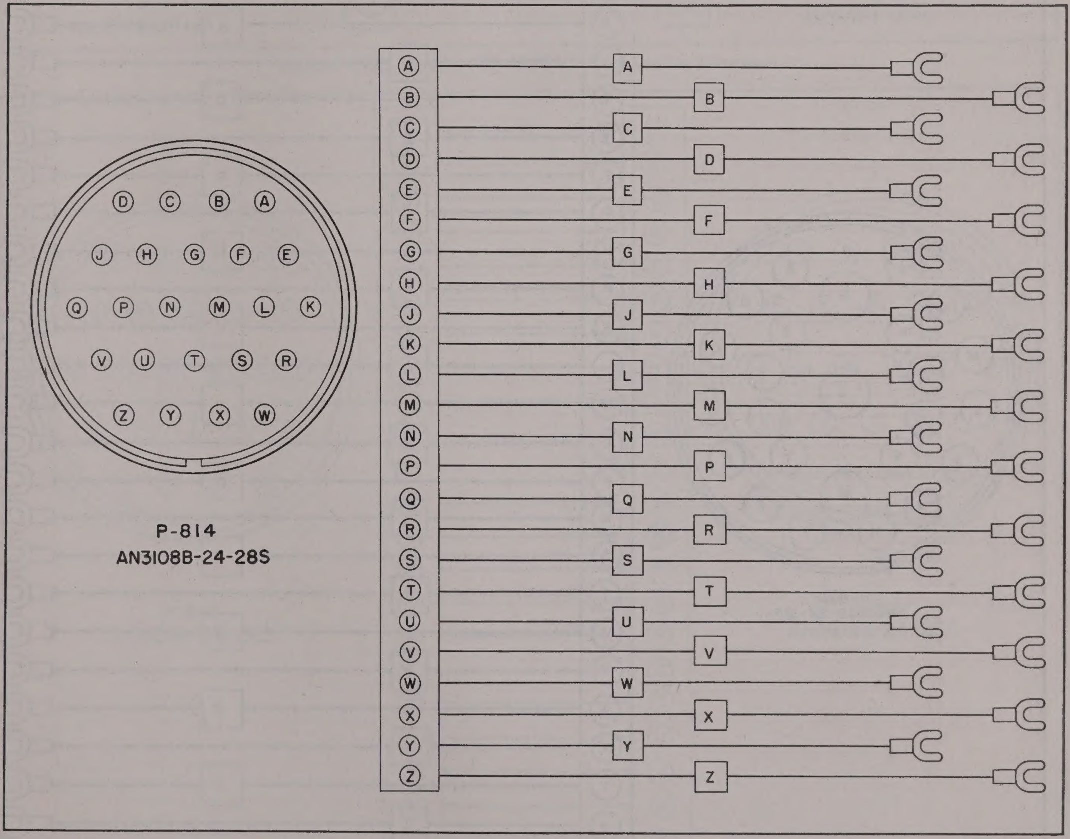


Figure 6-21. Cable CX-2015/U, Connection Diagram

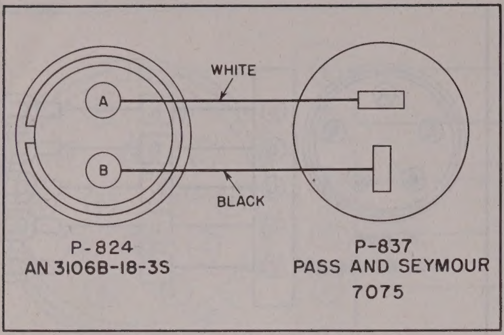


Figure 6-22. Cable CX-2009/U, Connection Diagram

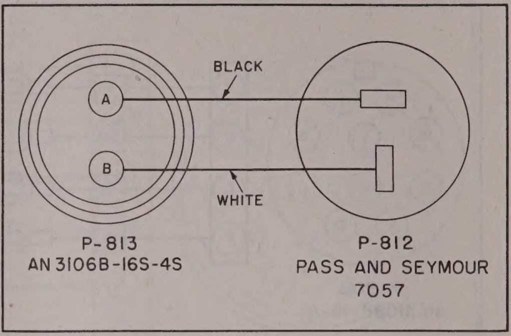


Figure 6-23. Cable CX-2010/U, Connection Diagram

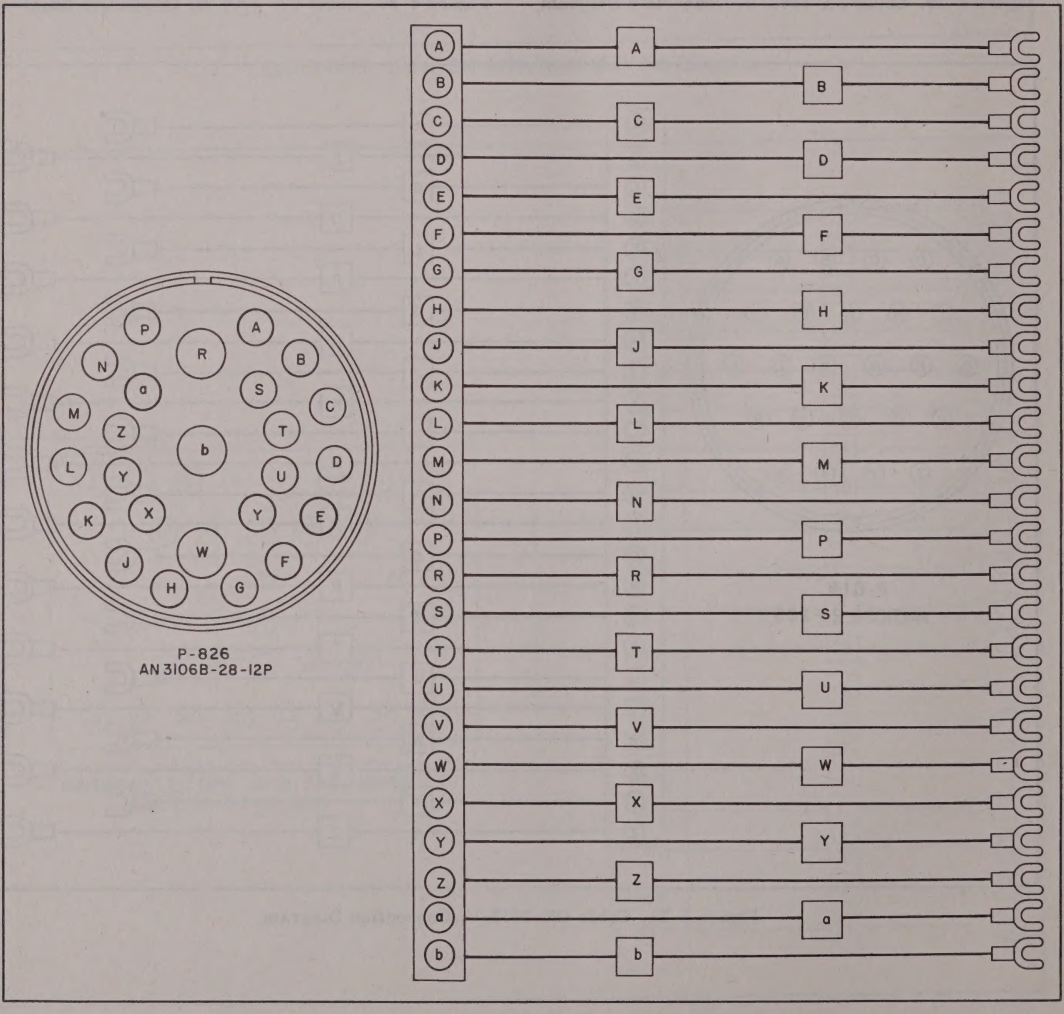


Figure 6-24. Cable CX-2014/U, Connection Diagram

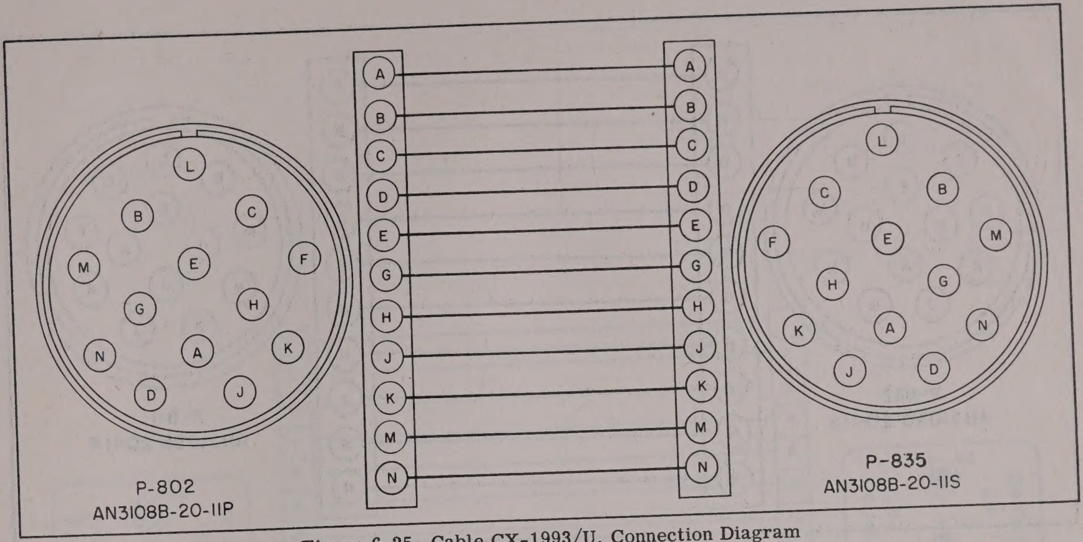


Figure 6-25. Cable CX-1993/U, Connection Diagram

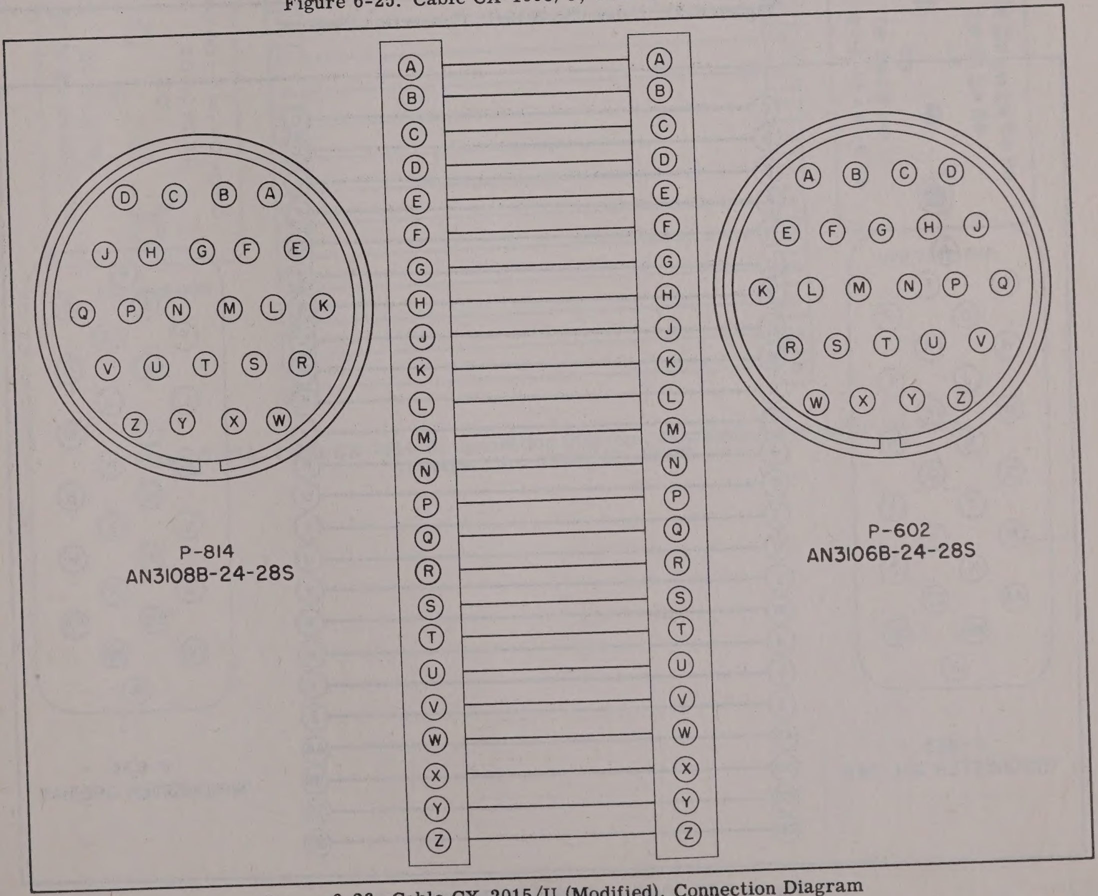


Figure 6-26. Cable CX-2015/U (Modified), Connection Diagram

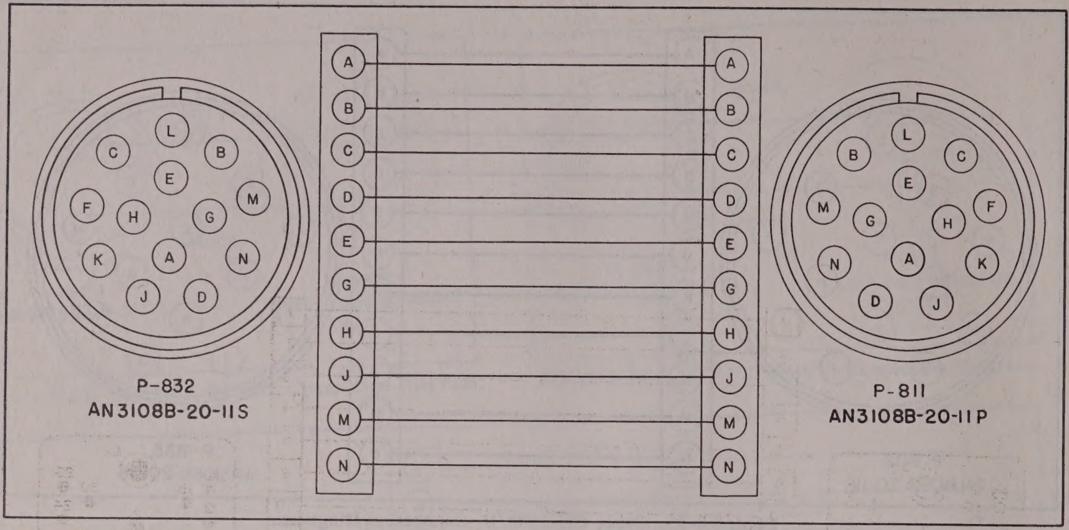


Figure 6-27. Cable CX-2013/U, Connection Diagram

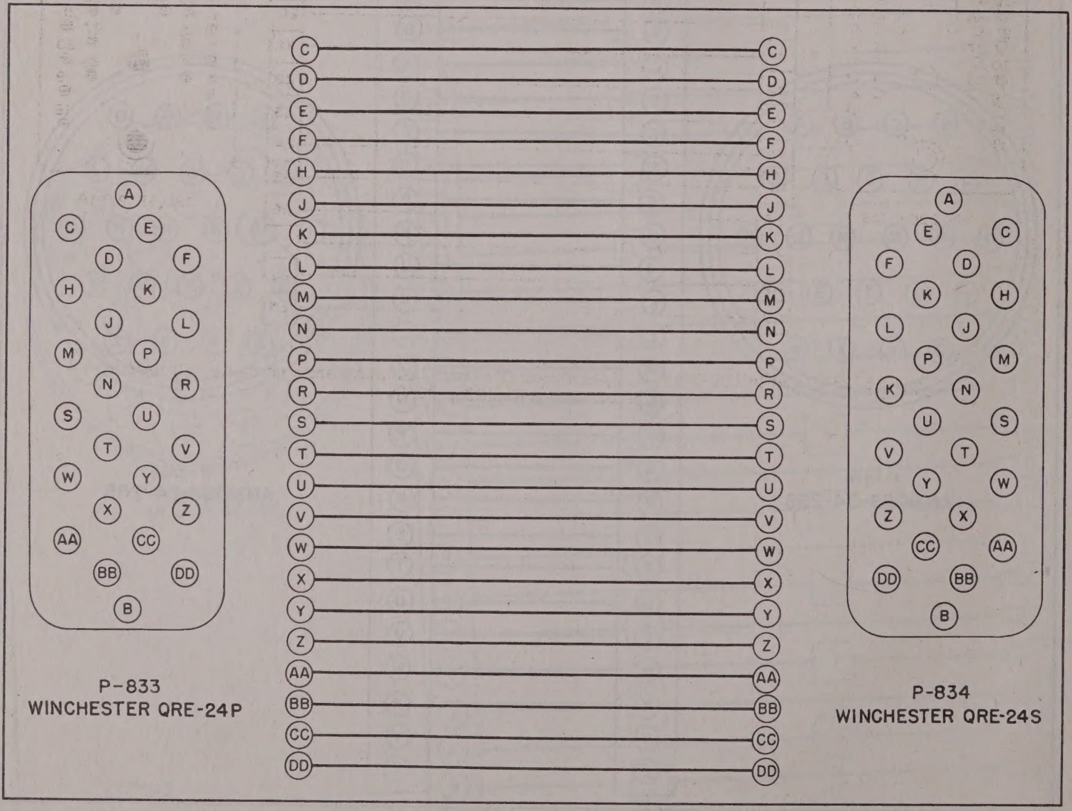


Figure 6-28. Cable CX-2016/U, Connection Diagram

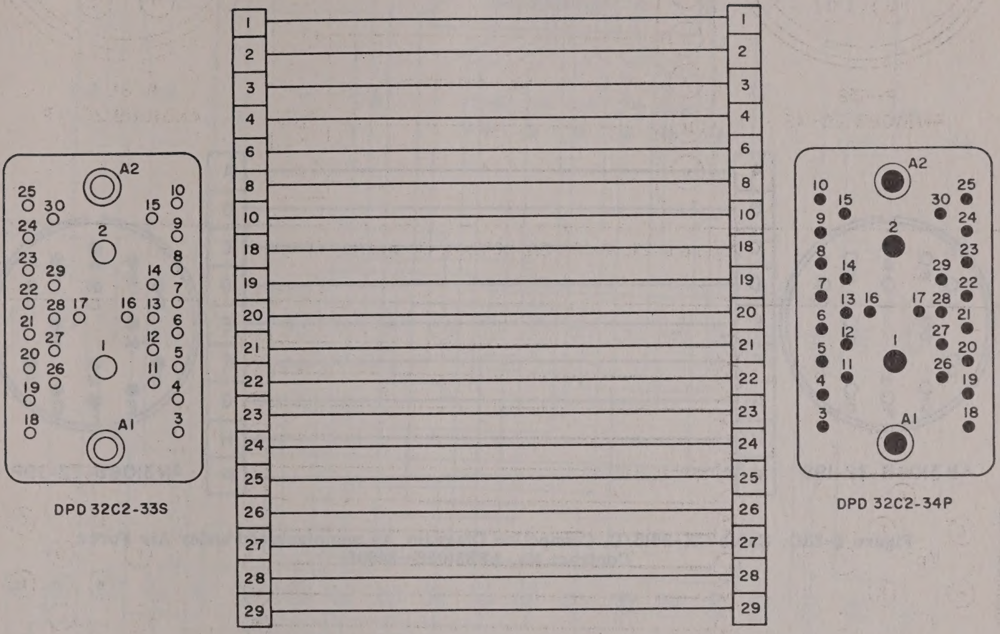


Figure 6-28A. Cable CX-2614/U, Connection Diagram, as manufactured under Air Force Contract No. AF33(038)-30605

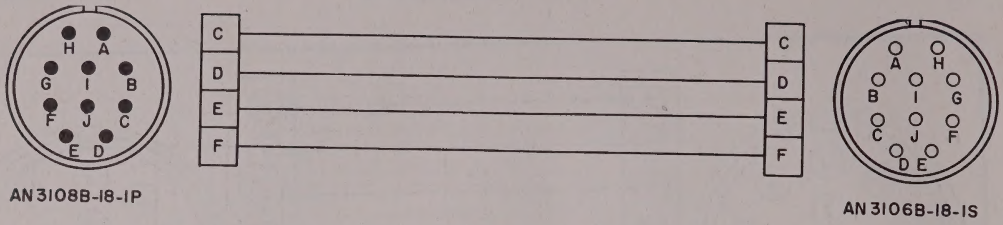


Figure 6-28B. Cable CX-2615/U, Connection Diagram, as manufactured under Air Force Contract No. AF33(038)-30605

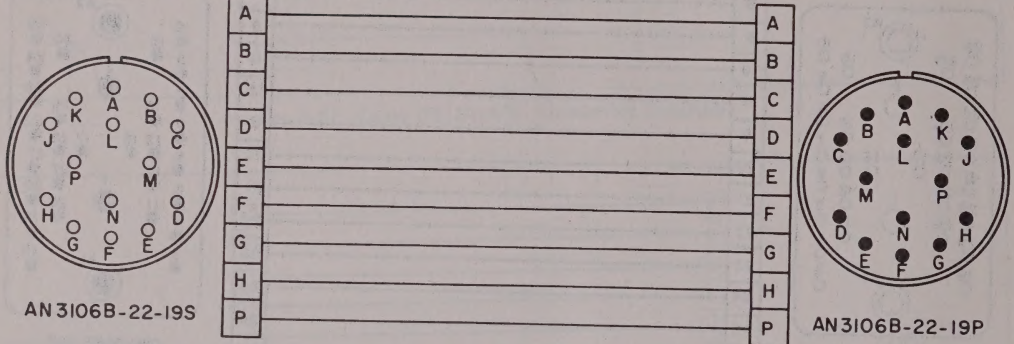


Figure 6-28C. Cable CX-2616/U, Connection Diagram, as manufactured under Air Force Contract No. AF33(038)-30605

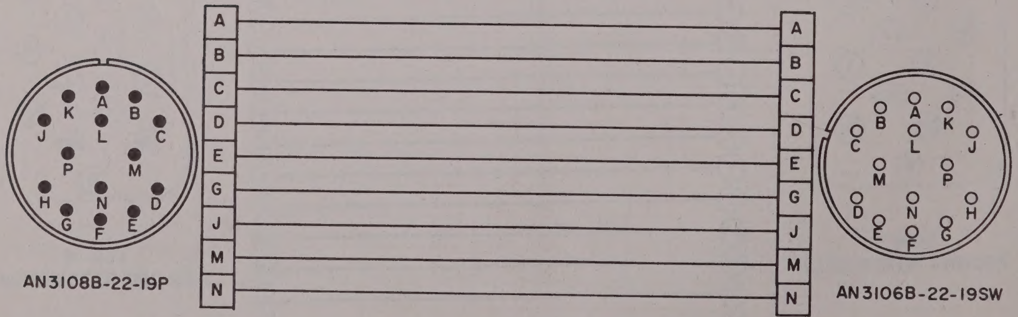


Figure 6-28D. Cable CX-2613/U, Connection Diagram, as manufactured under Air Force Contract No. AF33(038)-30605

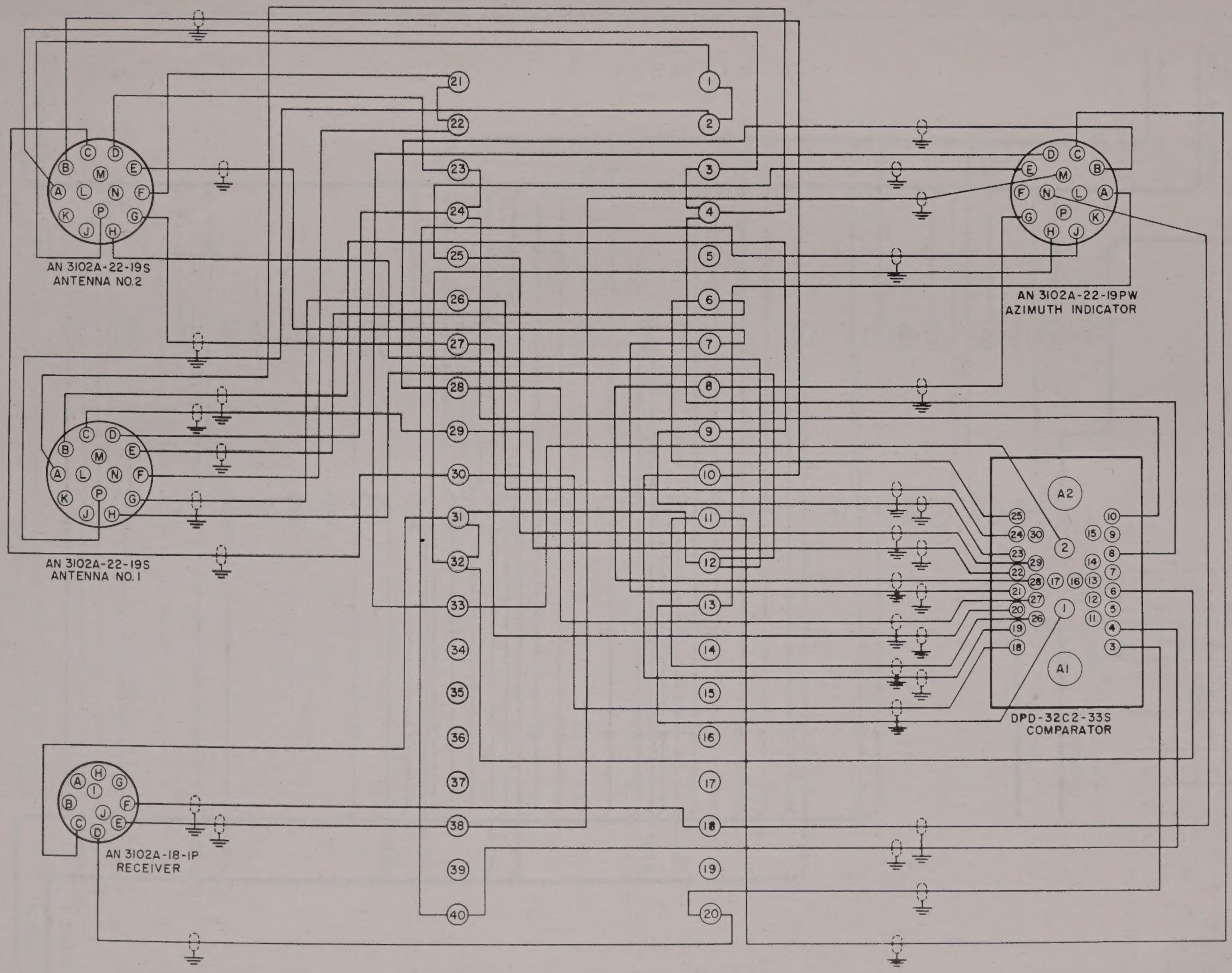


Figure 6-28E. Power Distribution Panel SB-349/CRD-6, as manufactured under **Air Force** Contract No. **AF33**(038)-30605

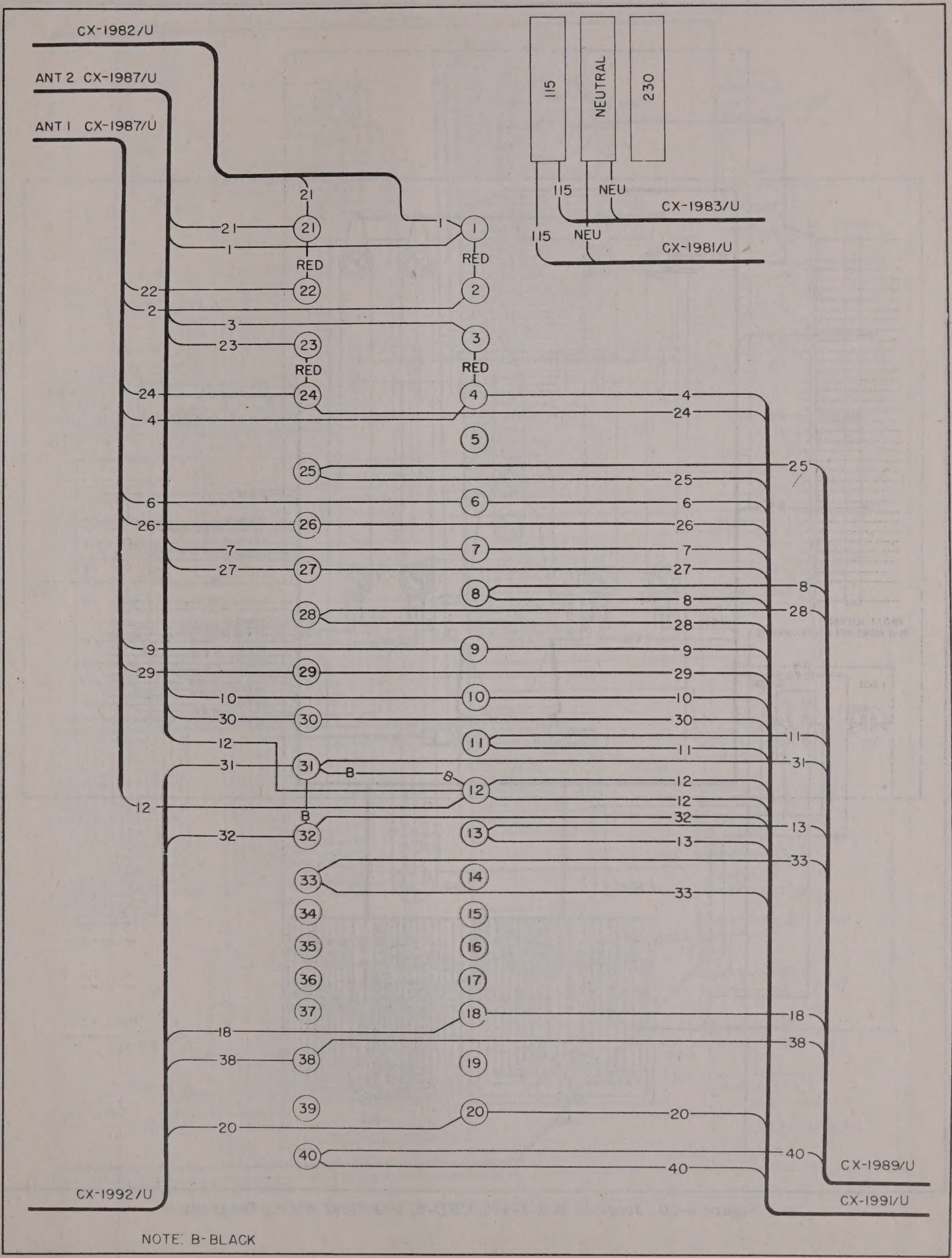


Figure 6-29. Distribution Terminal Panel J-390/GR, Practical Wiring Diagram

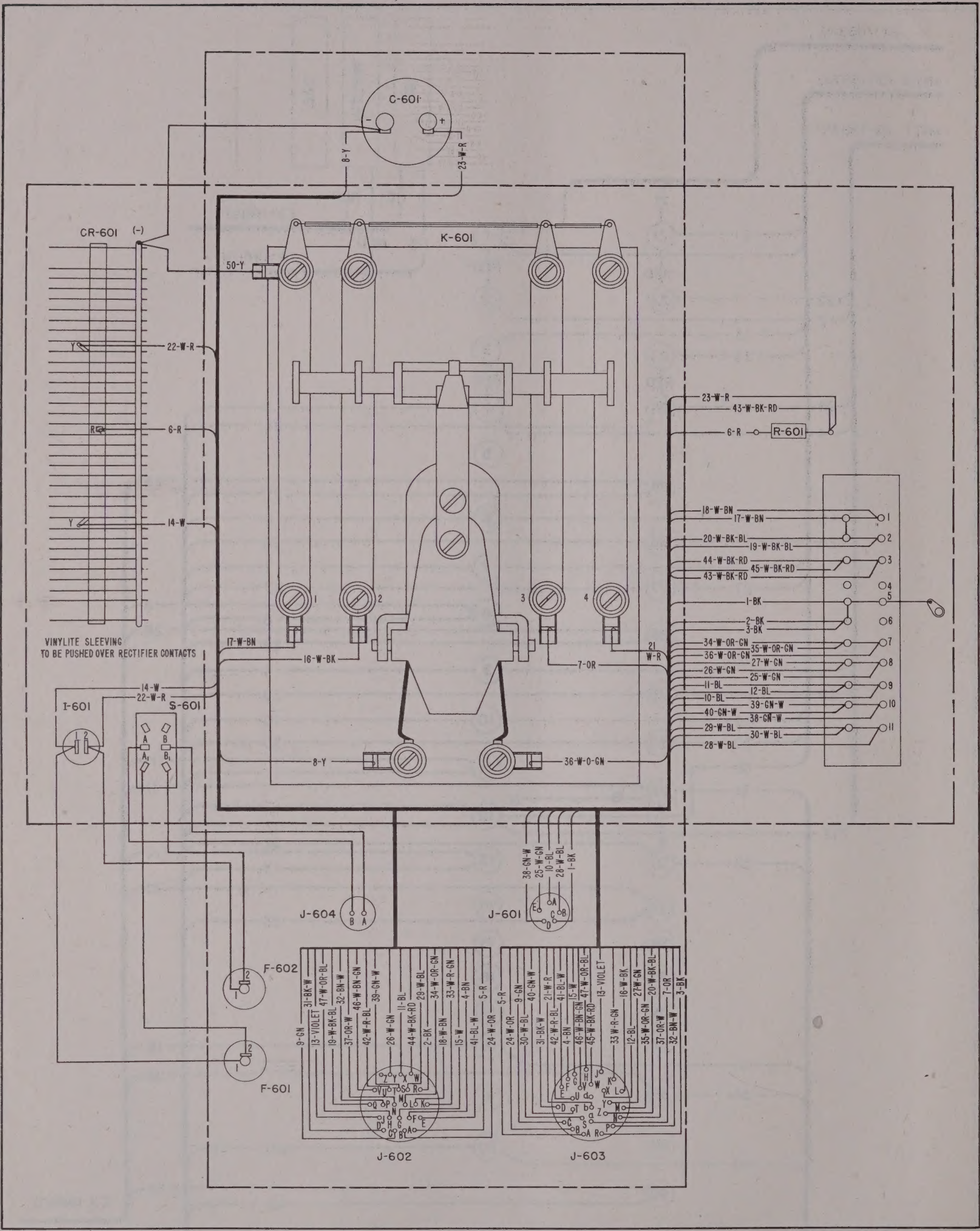
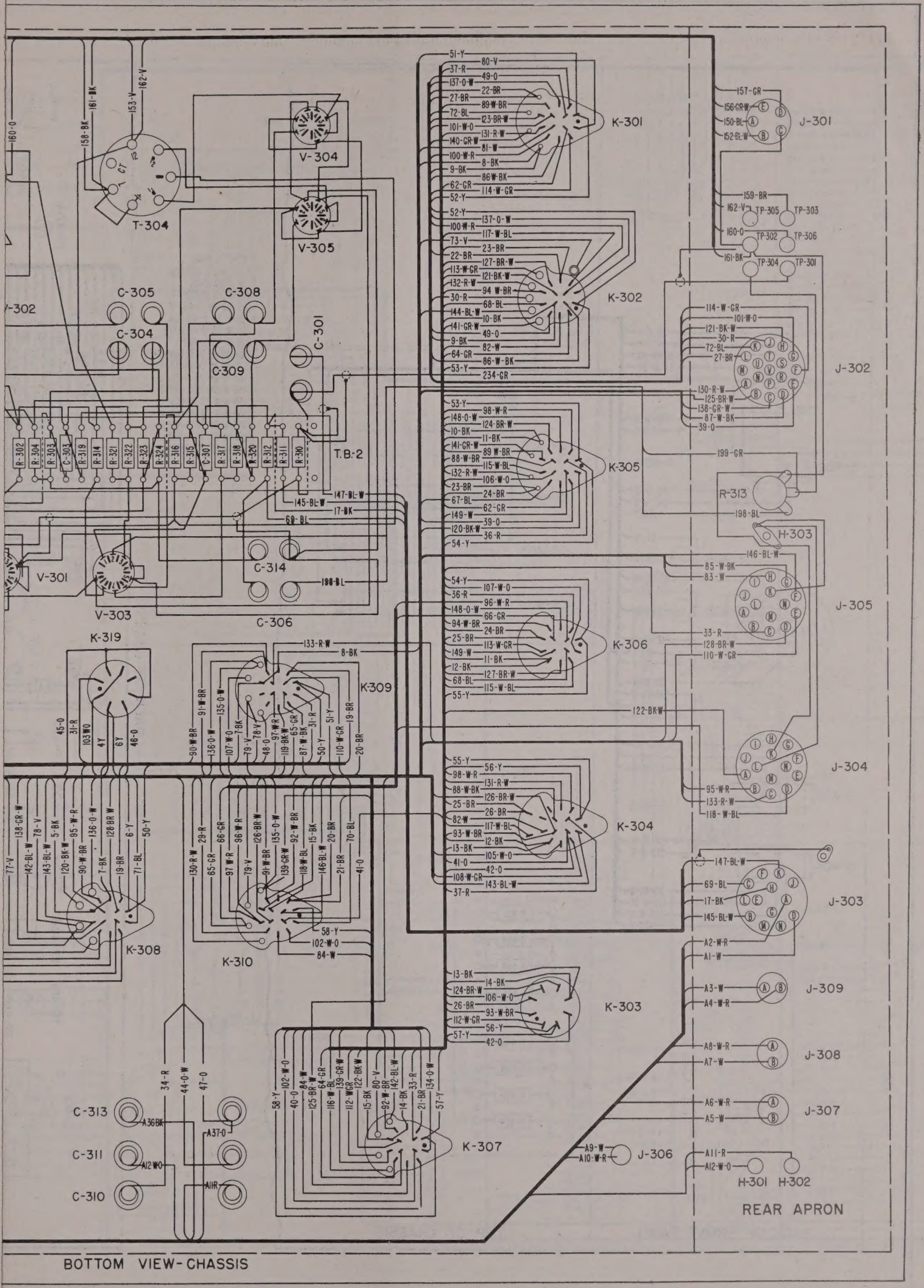


Figure 6-30. Junction Box J-476/CRD-6, Practical Wiring Diagram


K-301
J-301
V-304
T-304
V-305
TP-305
TP-303
TP-302
TP-306
TP-304
TP-301
V-302
C-305
C-308
C-304
C-301
C-309
K-302
J-302
T.B.-2
K-305
R-313
H-303
C-314
V-301
V-303
C-306
J-305
K-319
K-306
K-309
J-304
K-304
J-303
K-308
K-310
K-303
J-309
J-308
J-307
C-313
C-311
C-310
K-307
J-306
H-301
H-302
REAR APRON
BOTTOM VIEW-CHASSIS

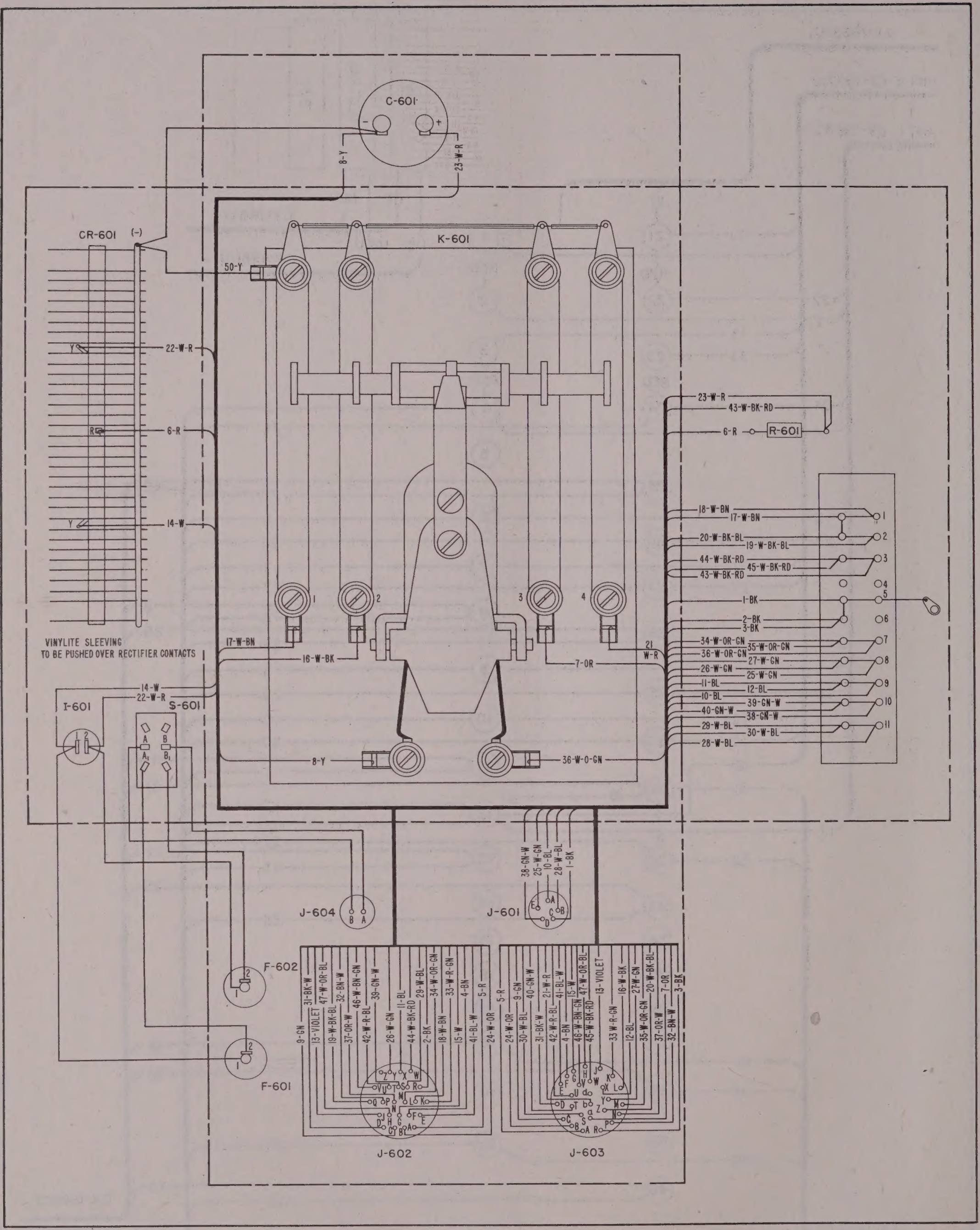


Figure 6-30. Junction Box J-476/CRD-6, Practical Wiring Diagram

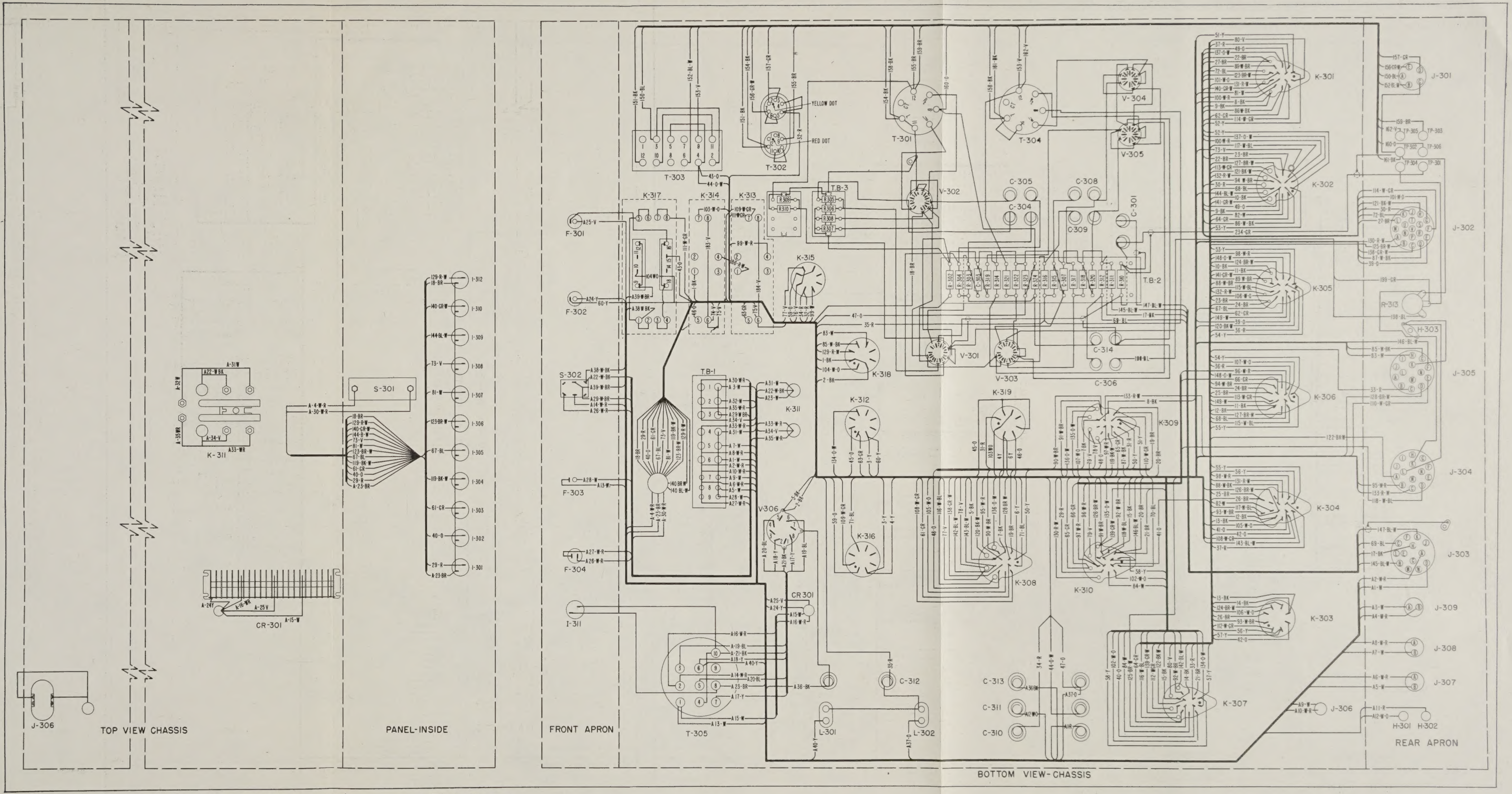
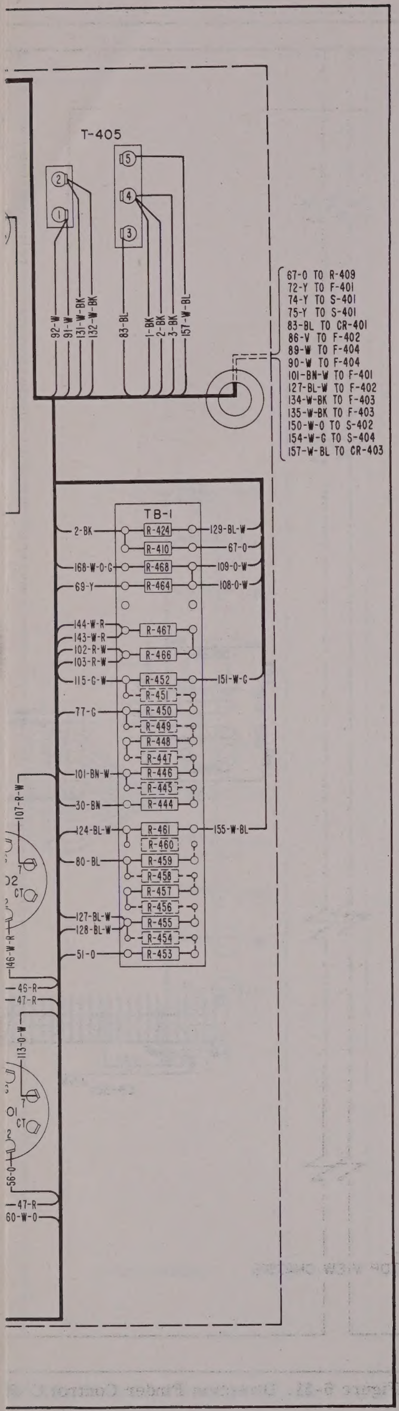
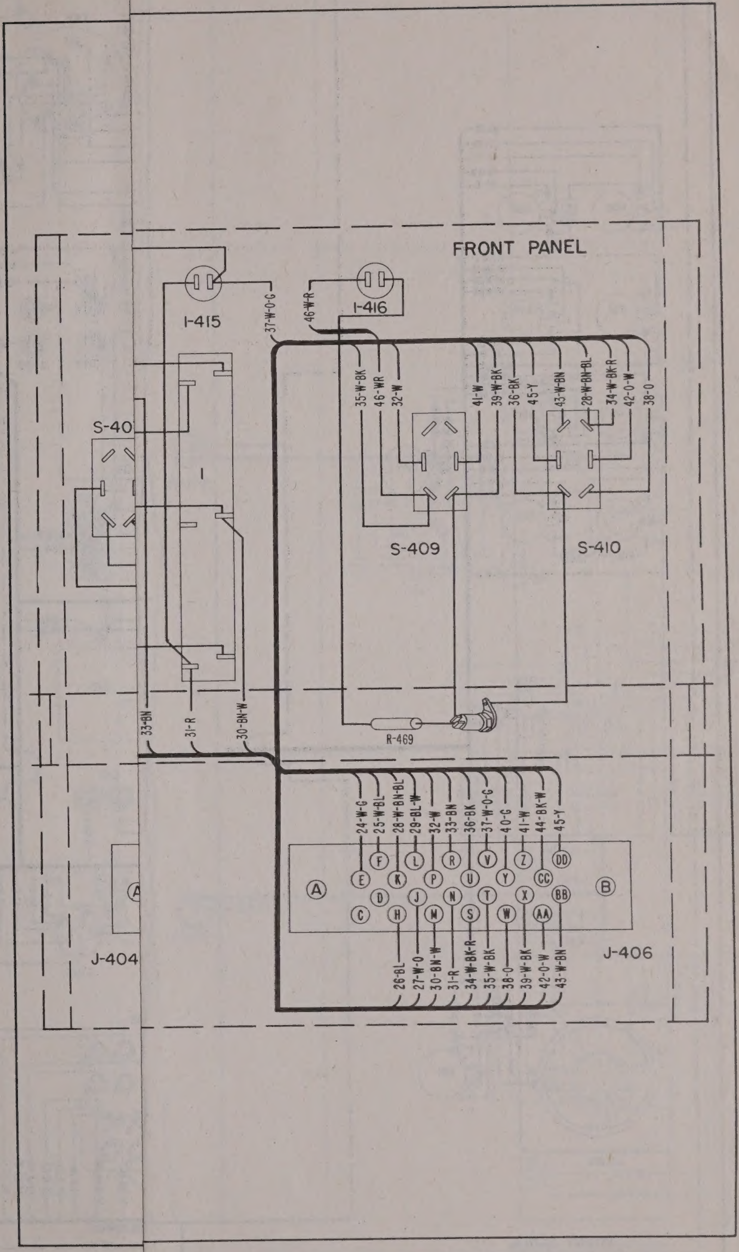


Figure 6-31. Direction Finder Control C-567/GRD, Practical Wiring Diagram



ring Diagram


FRONT PANEL
I-415
I-416
37-W-O-G
46-W-R
35-W-BK
46-WR
32-W
41-W
39-W-BK
36-BK
45-Y
43-W-BN
28-W-BN-BL
34-W-BK-R
42-O-W
38-O
S-40
S-409
S-410
R-469
33-BN
31-R
30-BN-W
24-W-G
25-W-BL
28-W-BN-BL
29-BL-W
32-W
33-BN
36-BK
37-W-O-G
40-G
41-W
44-BK-W
45-Y
E
F
L
R
V
Z
DD
A
K
P
U
Y
CC
B
D
J
N
T
X
BB
C
H
M
S
W
AA
26-BL
27-W-O
30-BN-W
31-R
34-W-BK-R
35-W-BK
38-O
39-W-BK
42-O-W
43-W-BN
J-406
A
J-404

Figur

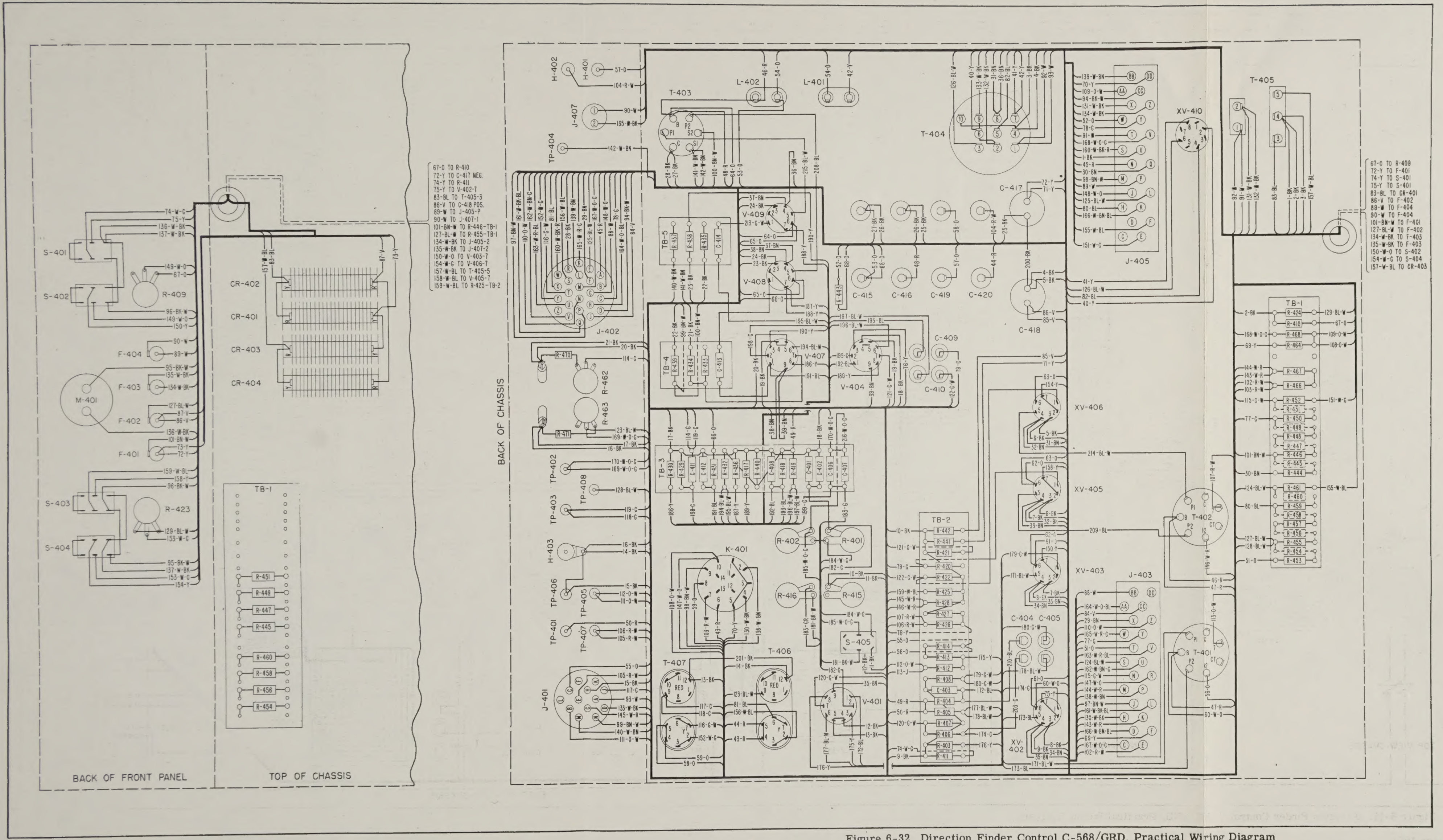


Figure 6-32. Direction Finder Control C-568/GRD, Practical Wiring Diagram

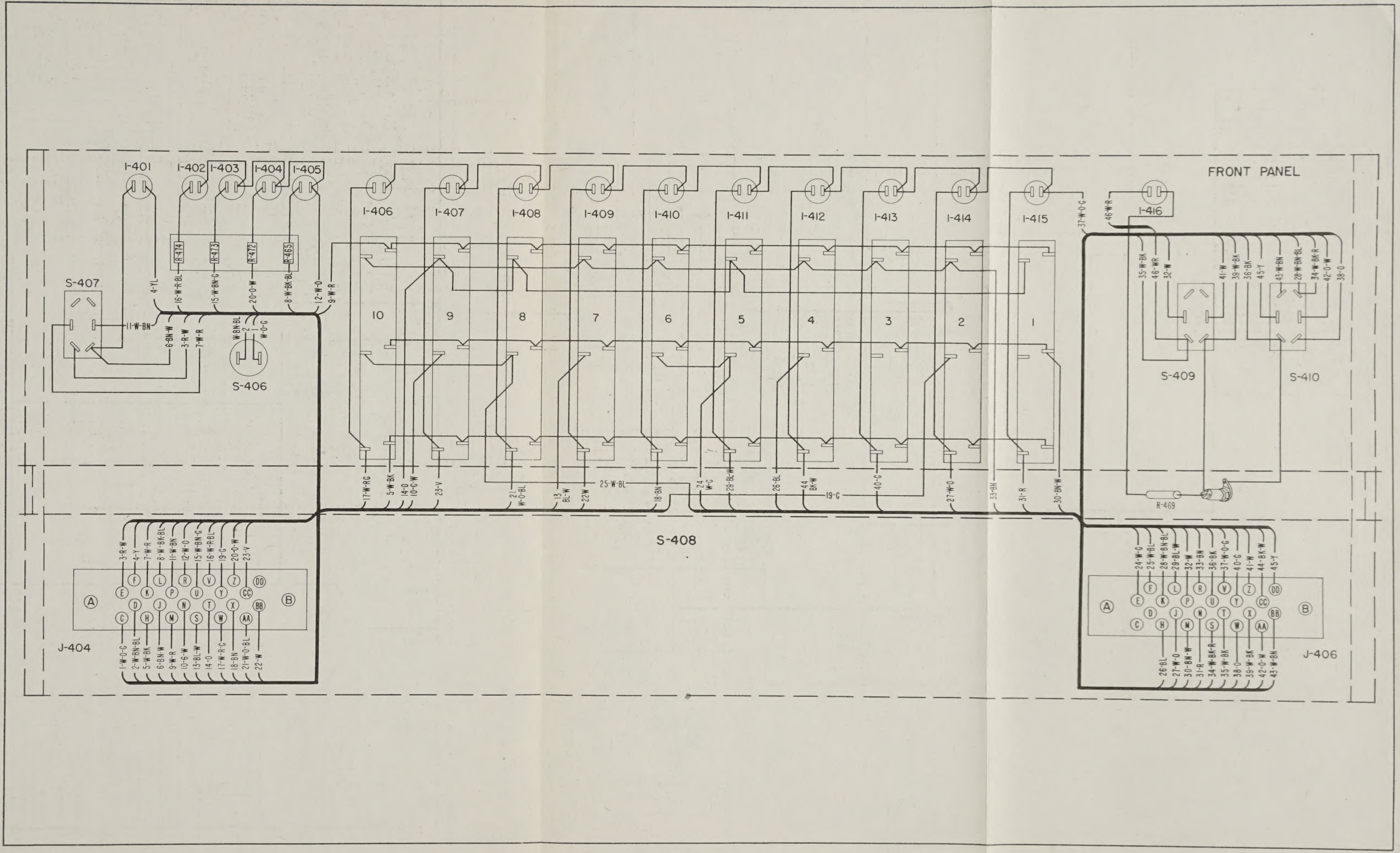


Figure 6-33. "Pull-Out" Panel, Direction Finder Control C-568/GRD. Practical Wiring Diagram

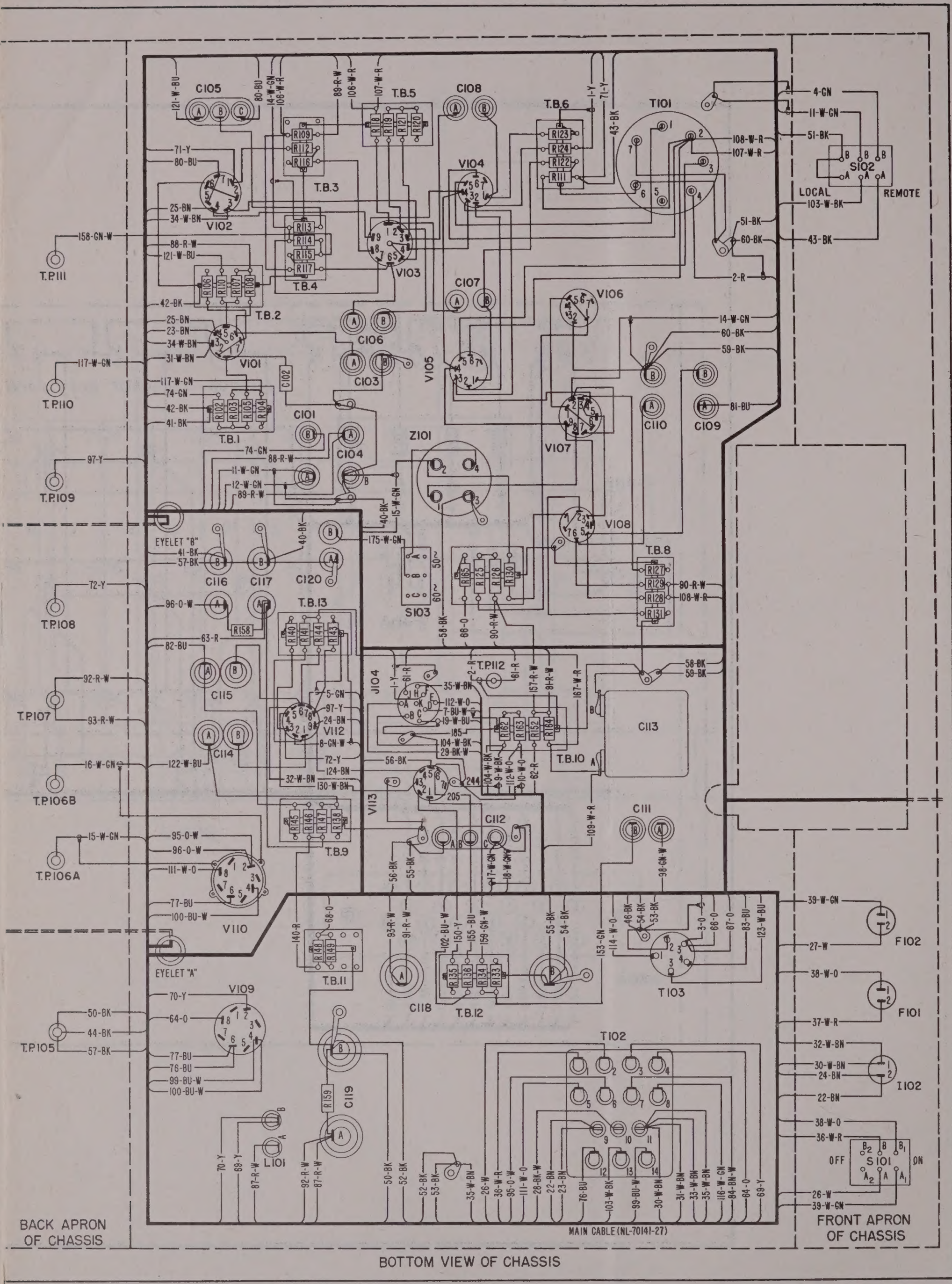
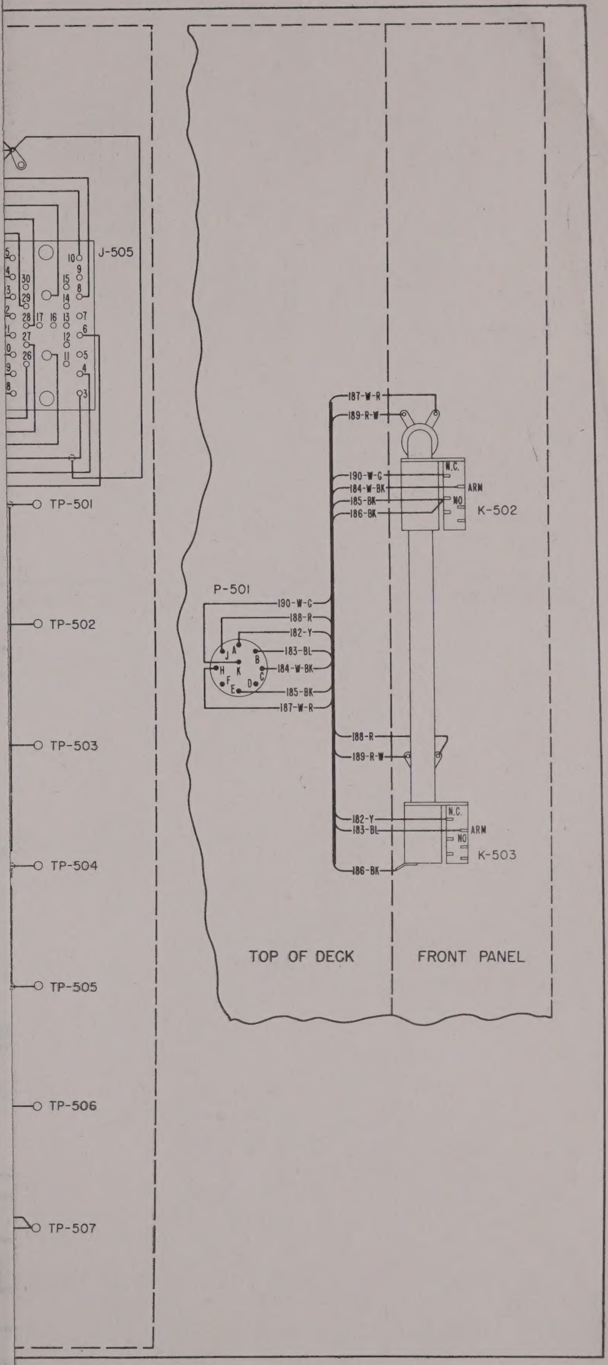


Figure 6-34. Azimuth Indicator ID-260/GRD, Practical Wiring Diagram


J-505
TP-501
TP-502
TP-503
TP-504
TP-505
TP-506
TP-507
P-501
187-W-R
189-R-W
190-W-G
184-W-BK
185-BK
186-BK
188-R
182-Y
183-BL
N.C.
ARM
NO
K-502
K-503
A
B
C
D
E
F
H
J
K
TOP OF DECK
FRONT PANEL

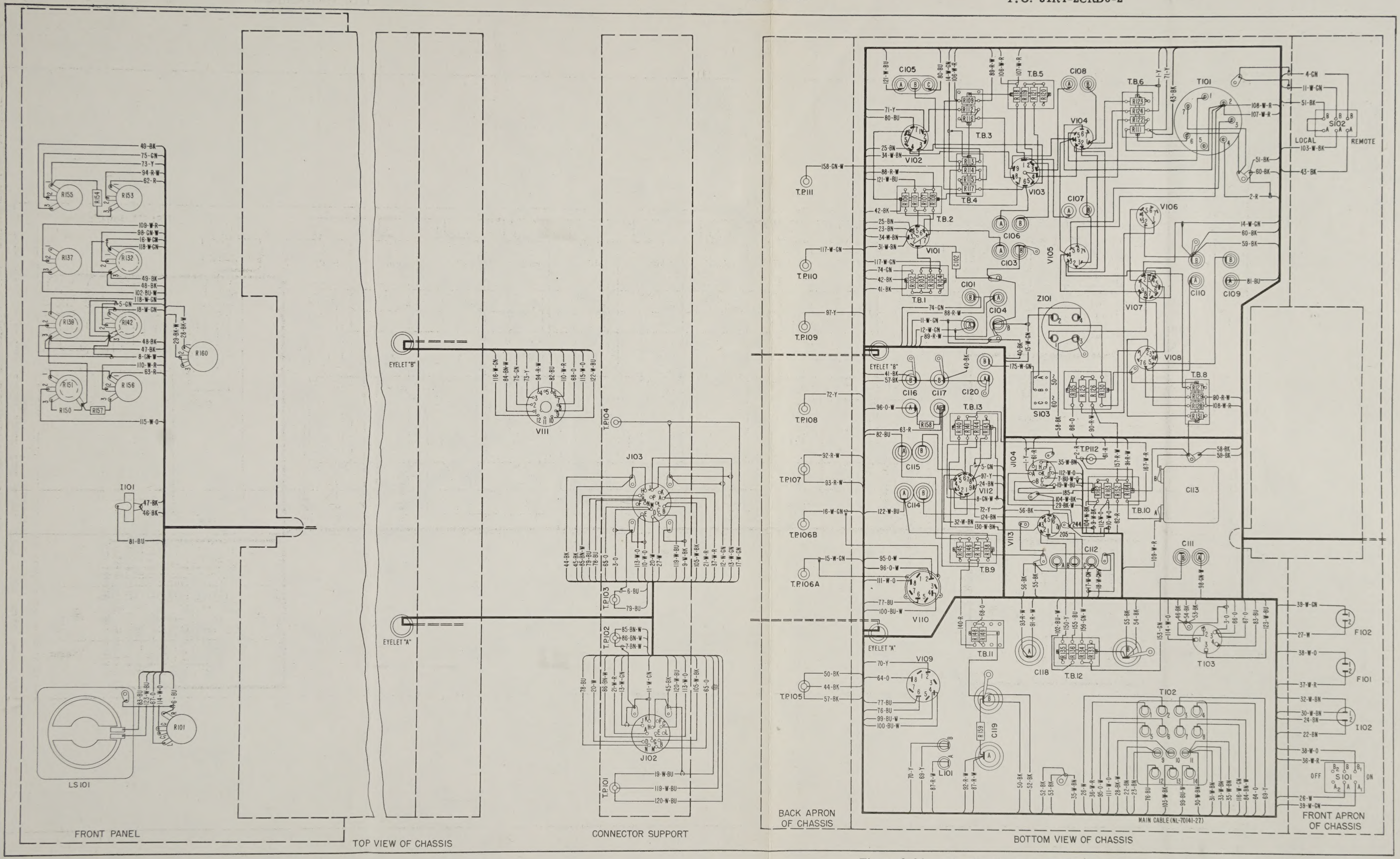


Figure 6-34. Azimuth Indicator ID-260/GRD, Practical Wiring Diagram

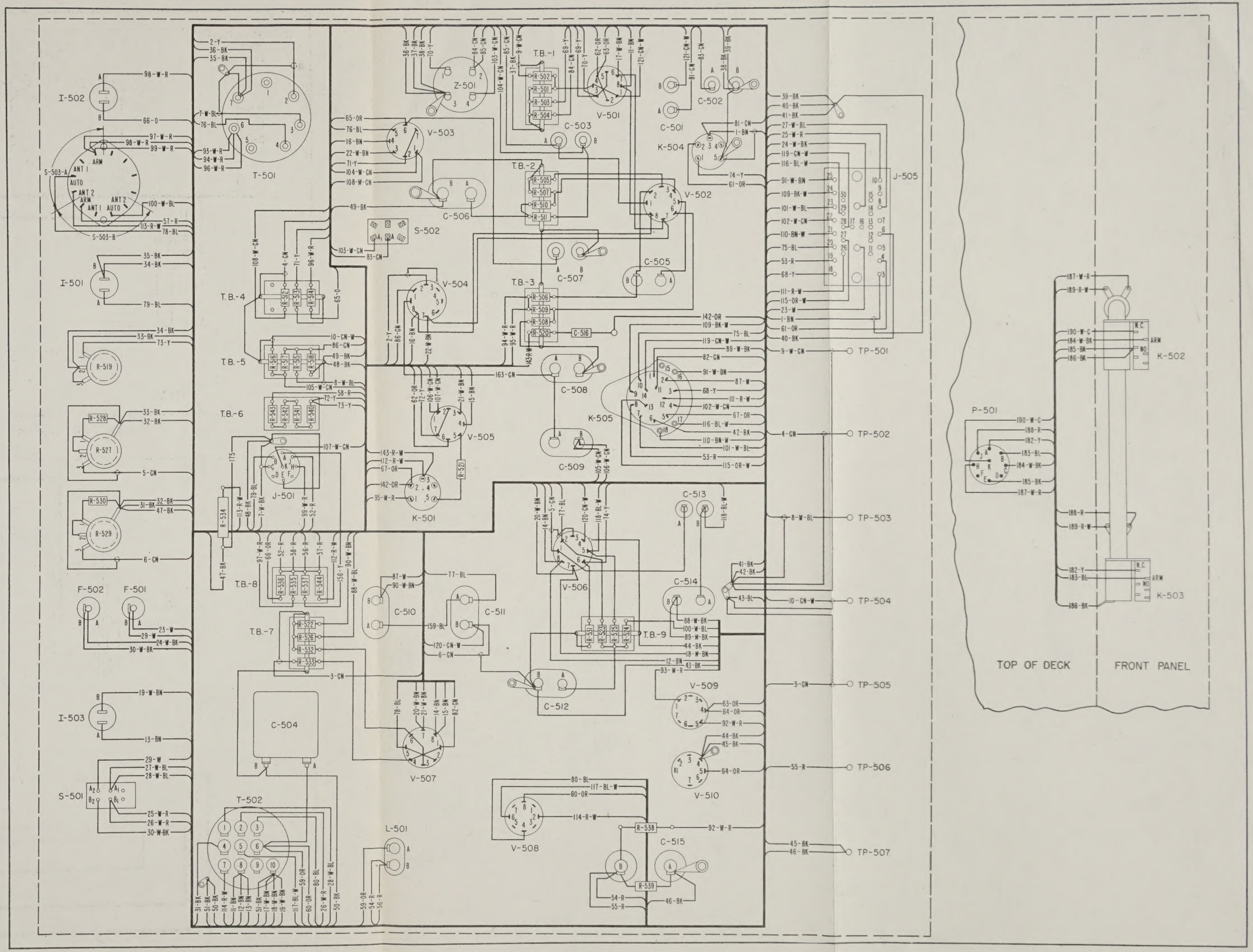


Figure 6-35. Comparator CM-23/GR, Practical Wiring Diagram

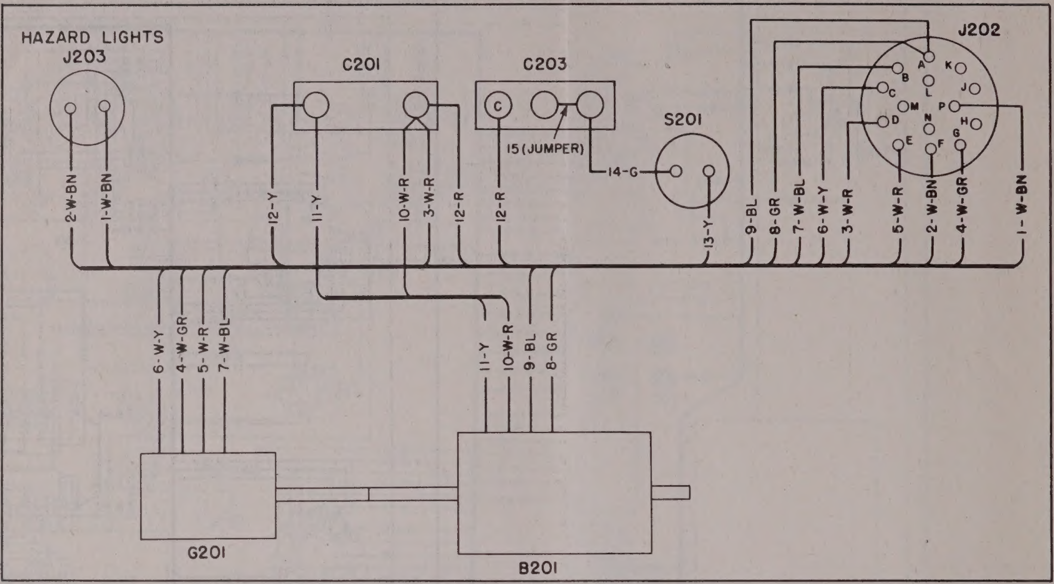


Figure 6-36. Antenna AS-449/GRD, Practical Wiring Diagram

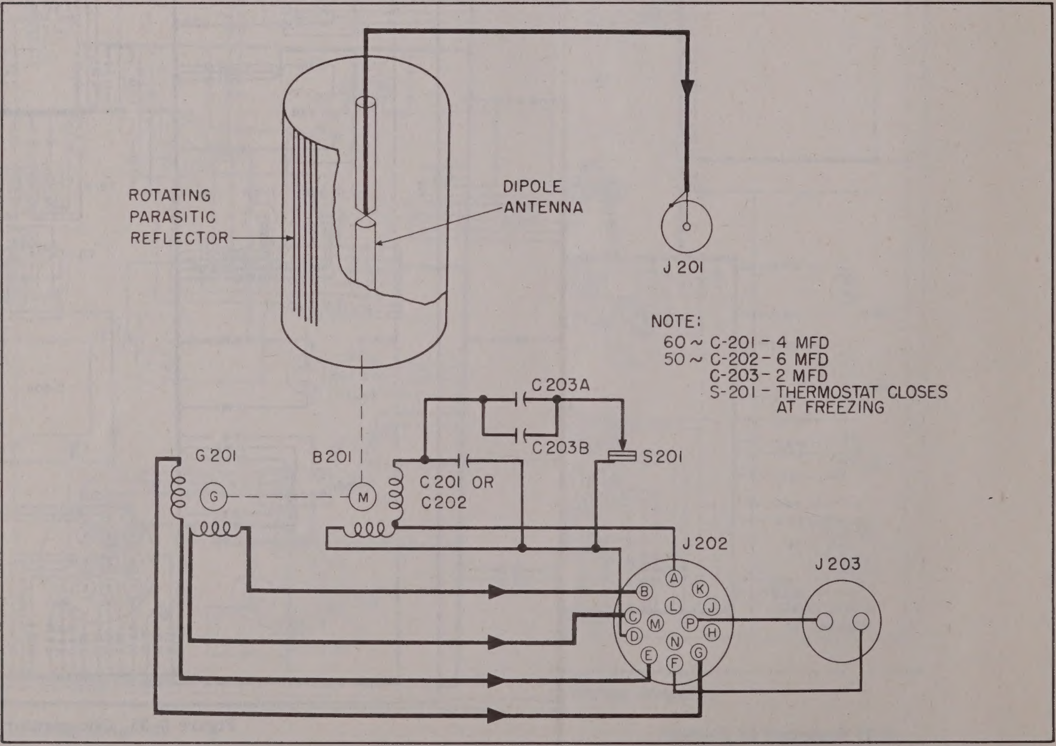
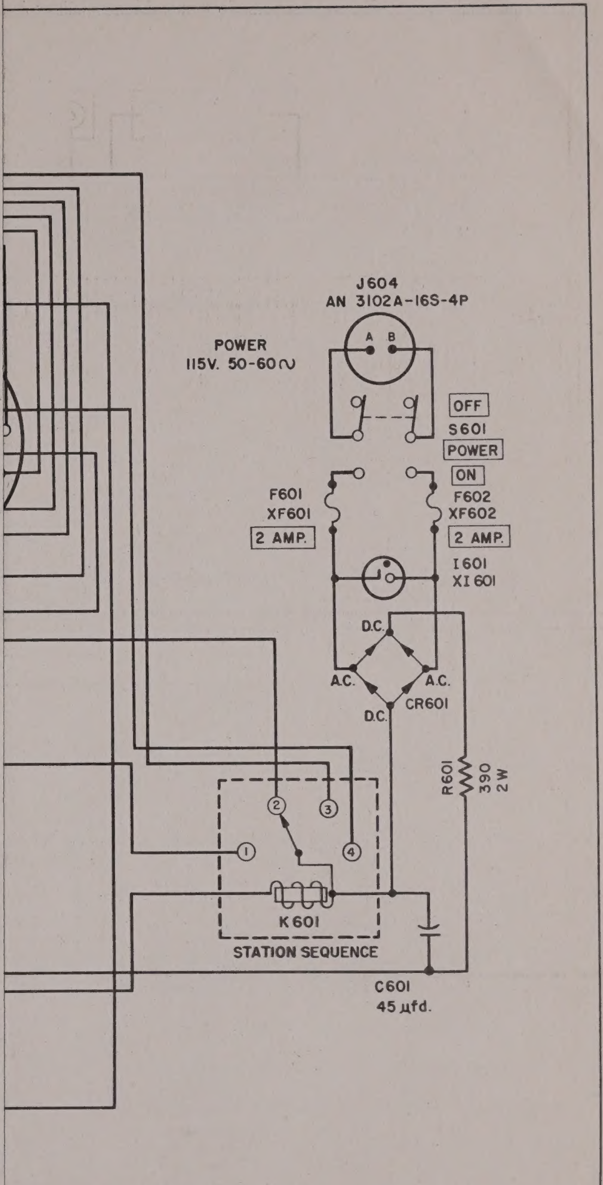


Figure 6-37. Antenna AS-449/GRD, Schematic Diagram


J604
AN 3102A-16S-4P
A
B
POWER
115V. 50-60∿
OFF
S601
POWER
ON
F601
XF601
2 AMP.
F602
XF602
2 AMP.
I601
XI601
D.C.
A.C.
A.C.
CR601
D.C.
R601
390
2W
②
③
①
④
K601
STATION SEQUENCE
C601
45 µfd.

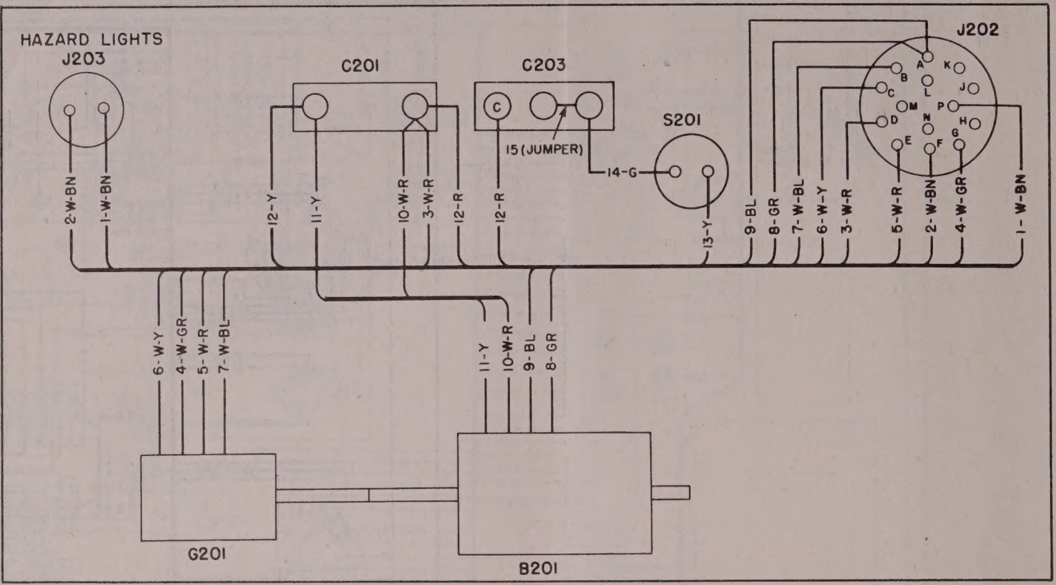
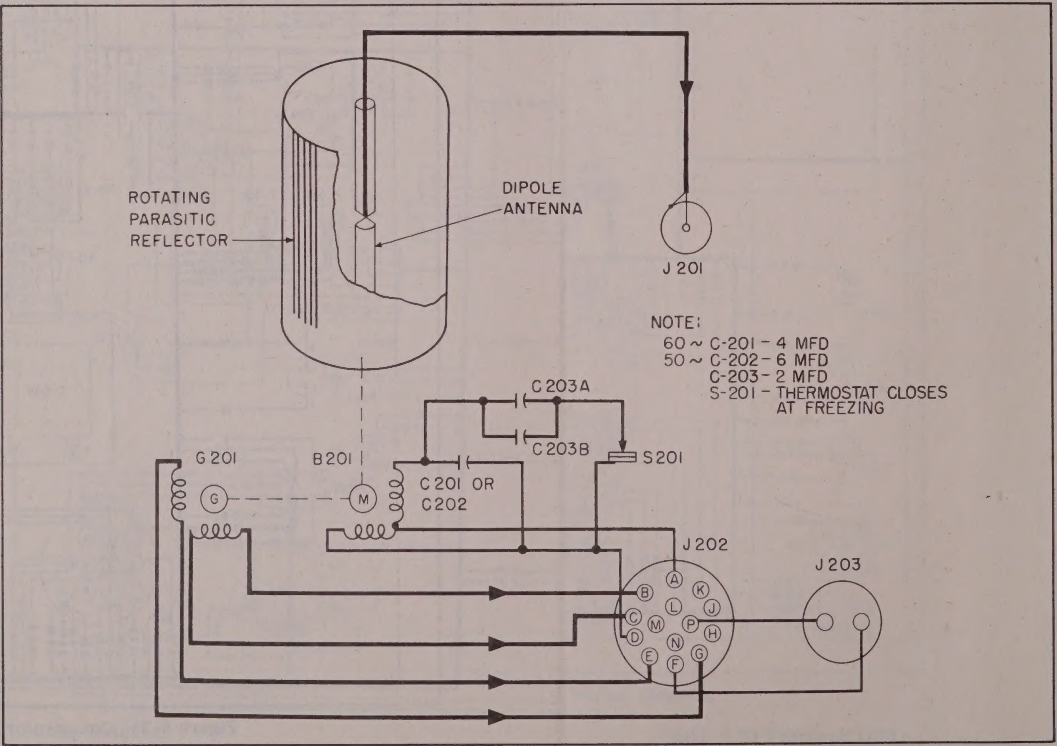


Figure 6-36. Antenna AS-449/GRD, Practical Wiring Diagram



NOTE:
60 ~ C-201 - 4 MFD
50 ~ C-202 - 6 MFD
C-203 - 2 MFD
S-201 - THERMOSTAT CLOSES AT FREEZING

Figure 6-37. Antenna AS-449/GRD, Schematic Diagram

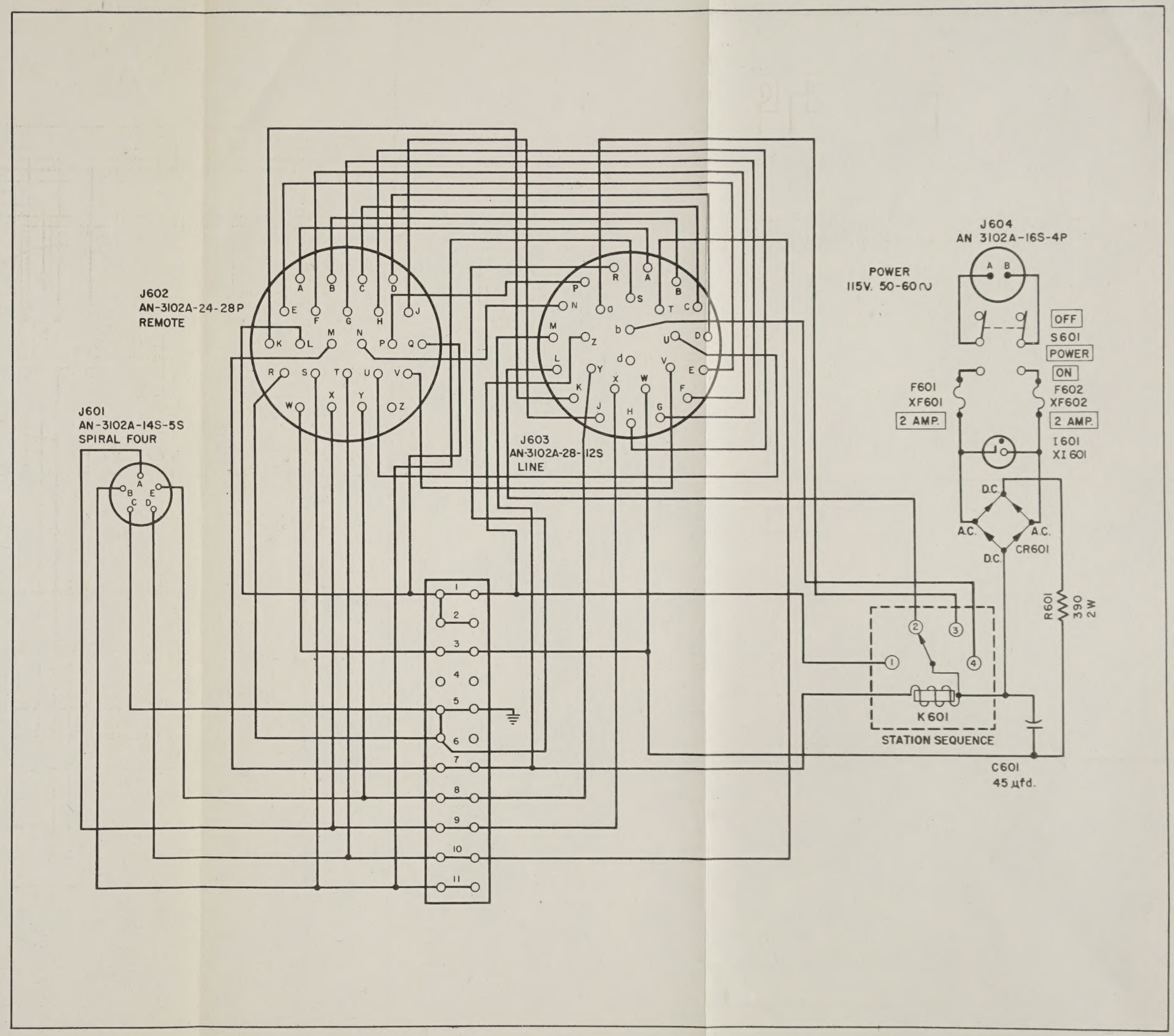
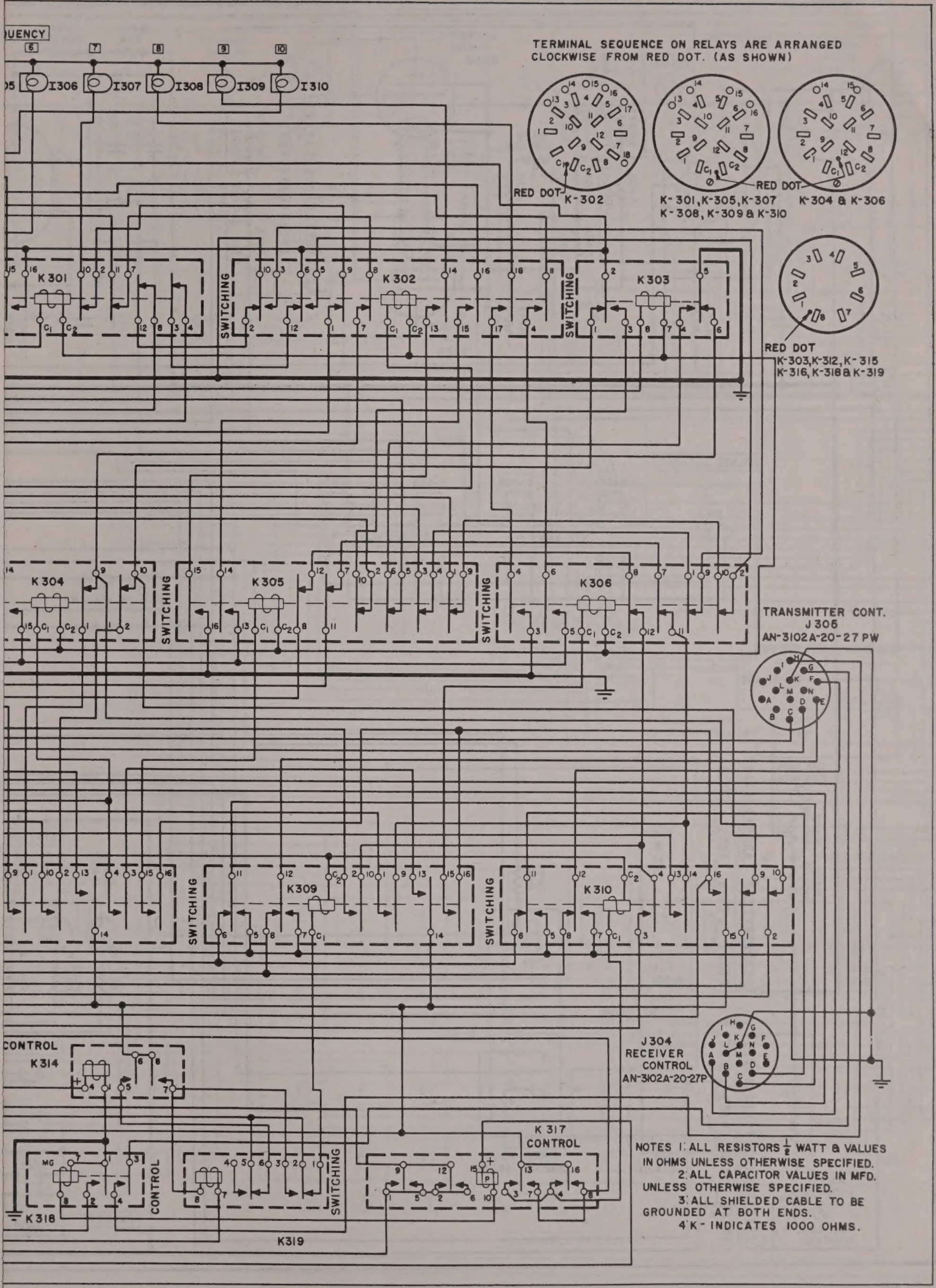
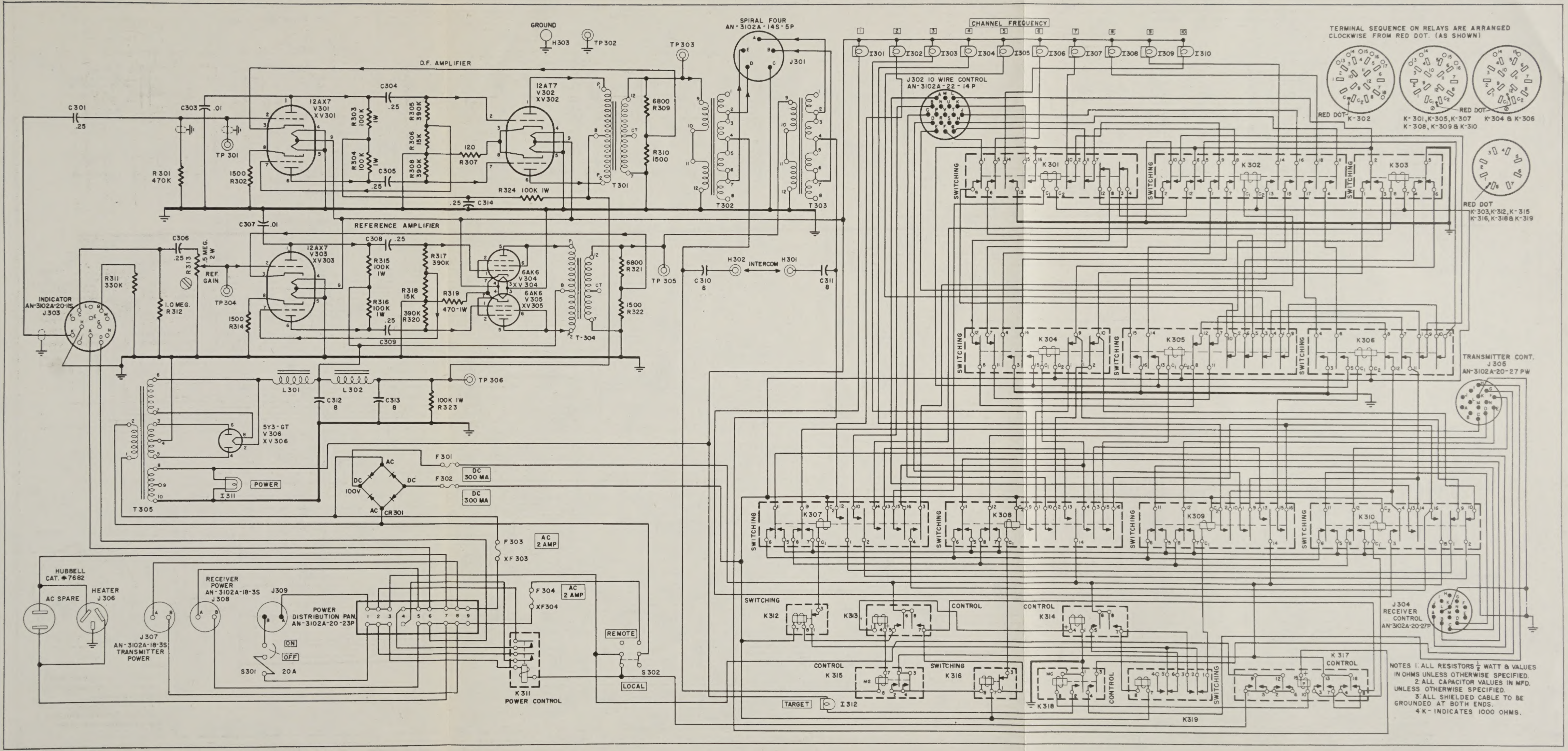


Figure 6-38. Junction Box J-476/CRD-6, Schematic Diagram

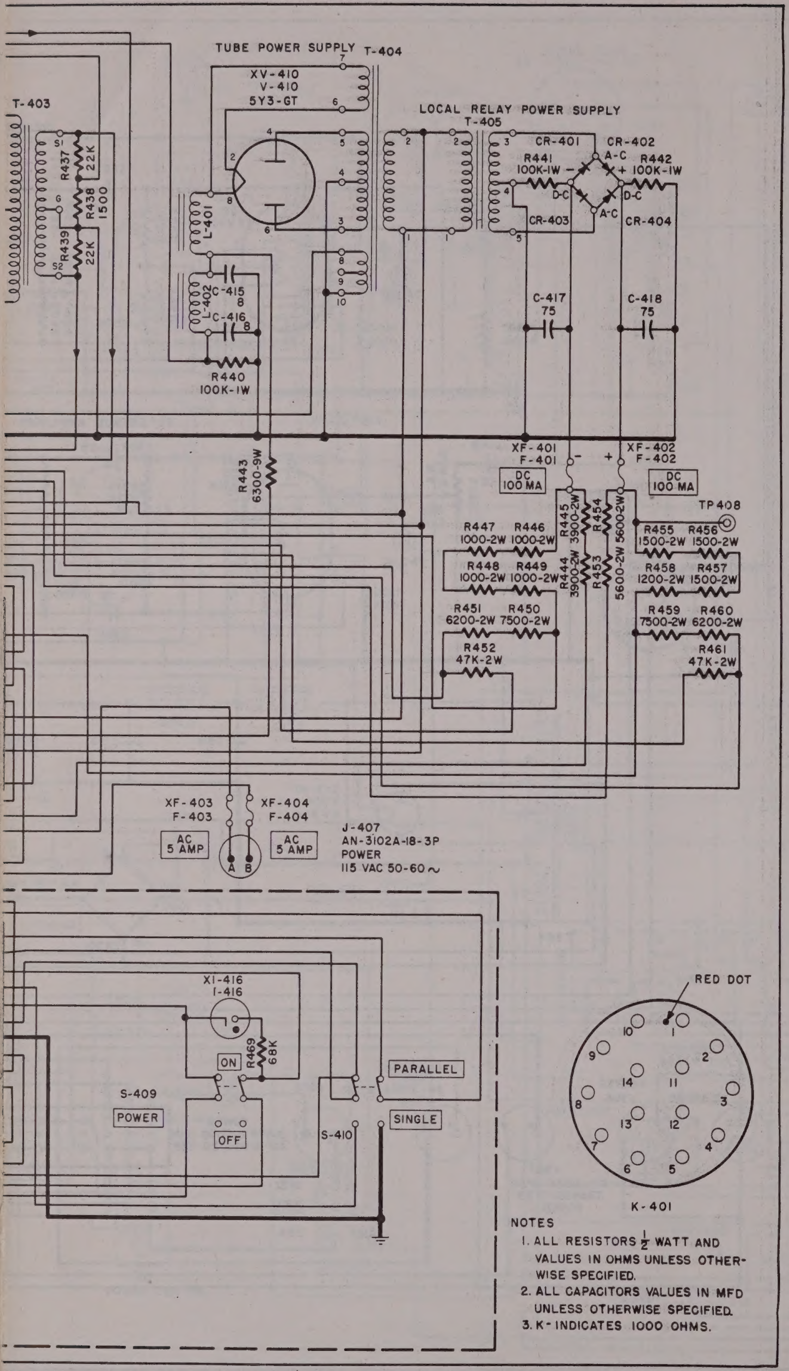

TERMINAL SEQUENCE ON RELAYS ARE ARRANGED CLOCKWISE FROM RED DOT. (AS SHOWN)

NOTES 1: ALL RESISTORS $\frac{1}{2}$ WATT & VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2: ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED.
3: ALL SHIELDED CABLE TO BE GROUNDED AT BOTH ENDS.
4: K- INDICATES 1000 OHMS.



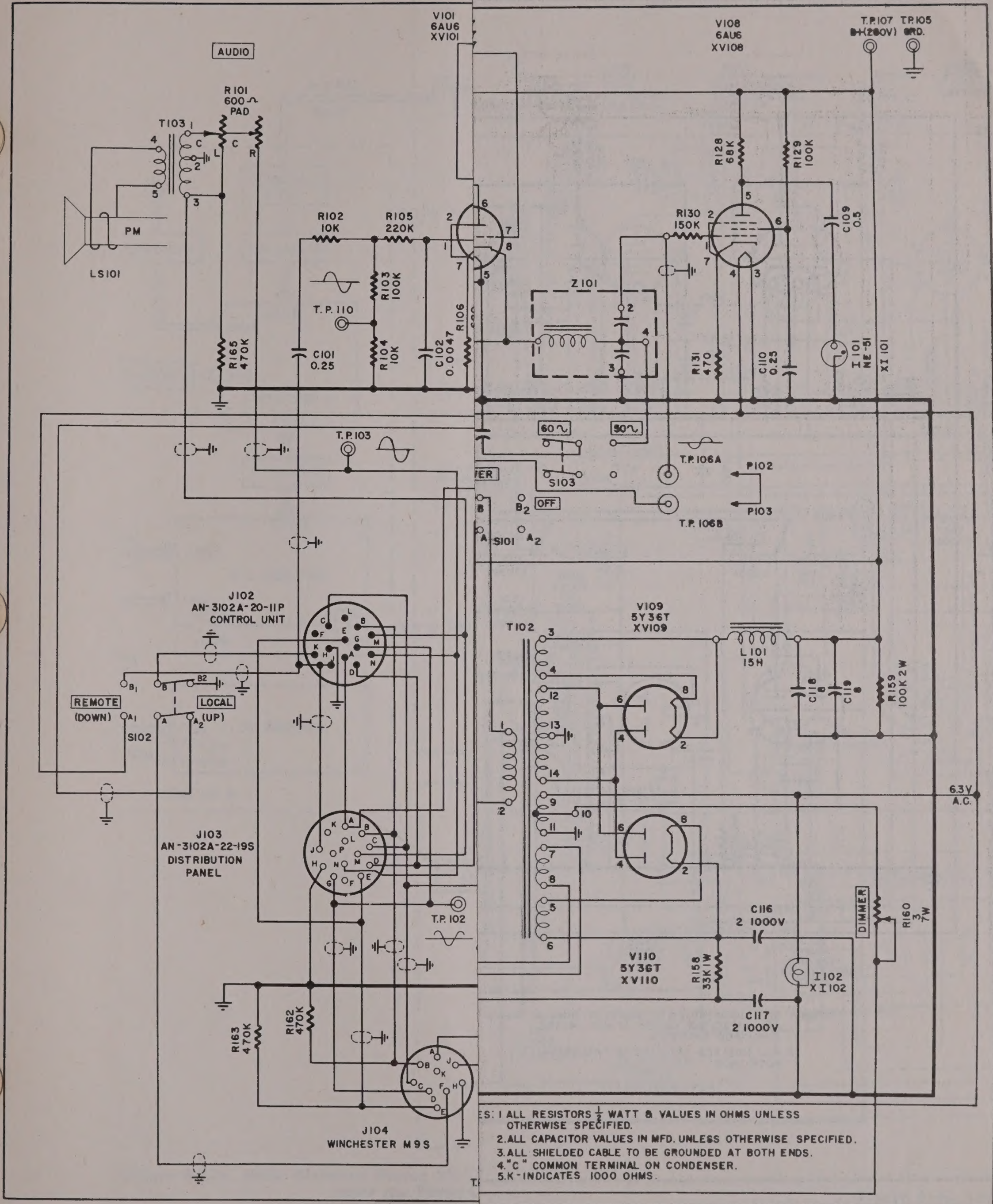
NOTES 1. ALL RESISTORS $\frac{1}{2}$ WATT & VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED.
3. ALL SHIELDED CABLE TO BE GROUNDED AT BOTH ENDS.
4. K- INDICATES 1000 OHMS.

Figure 6-39. Direction Finder Control C-567/GRD, Schematic Diagram



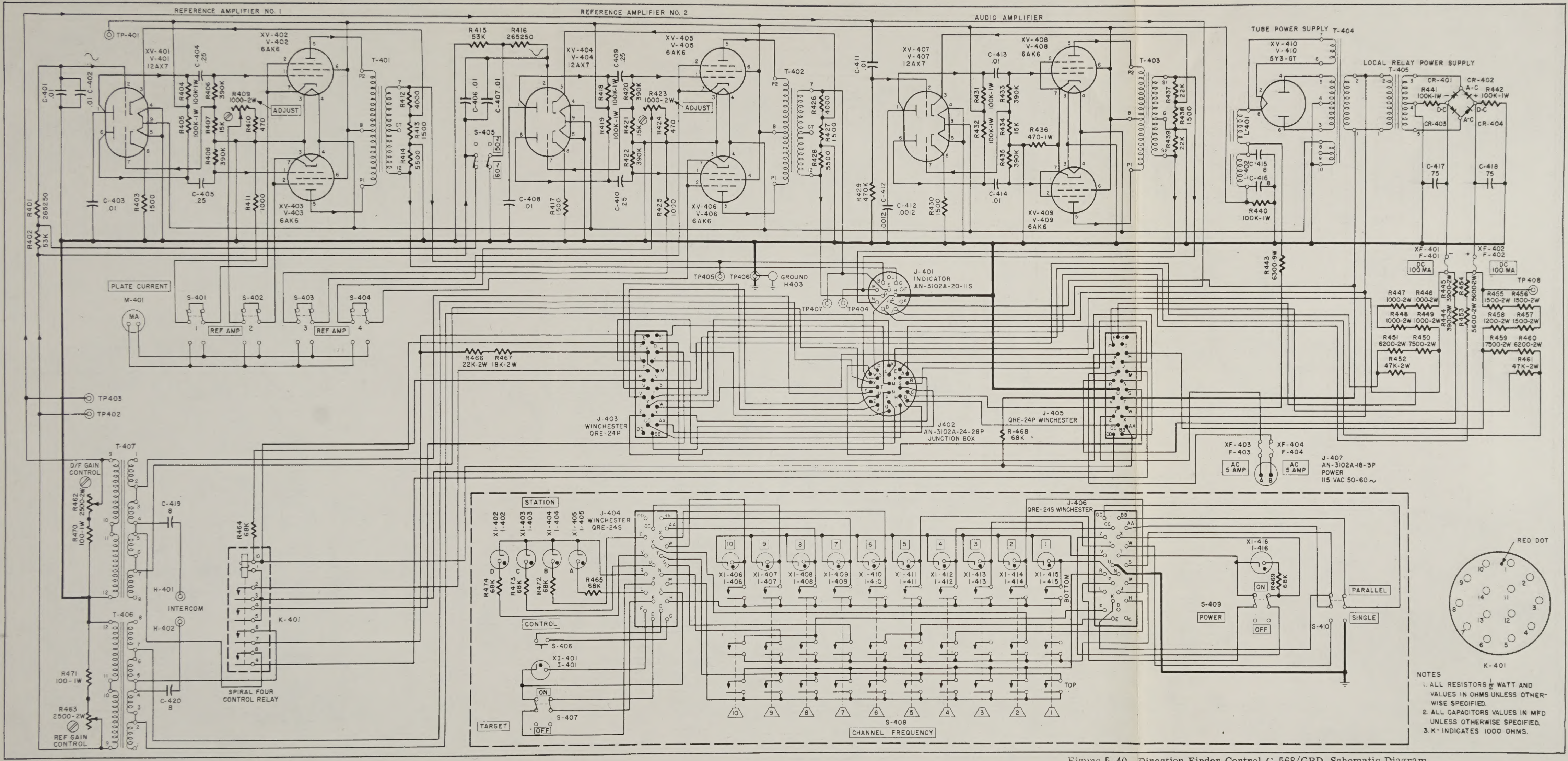
NOTES
1. ALL RESISTORS $\frac{1}{2}$ WATT AND VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS VALUES IN MFD UNLESS OTHERWISE SPECIFIED.
3. K- INDICATES 1000 OHMS.

Direction Finder Control C-568/GRD, Schematic Diagram



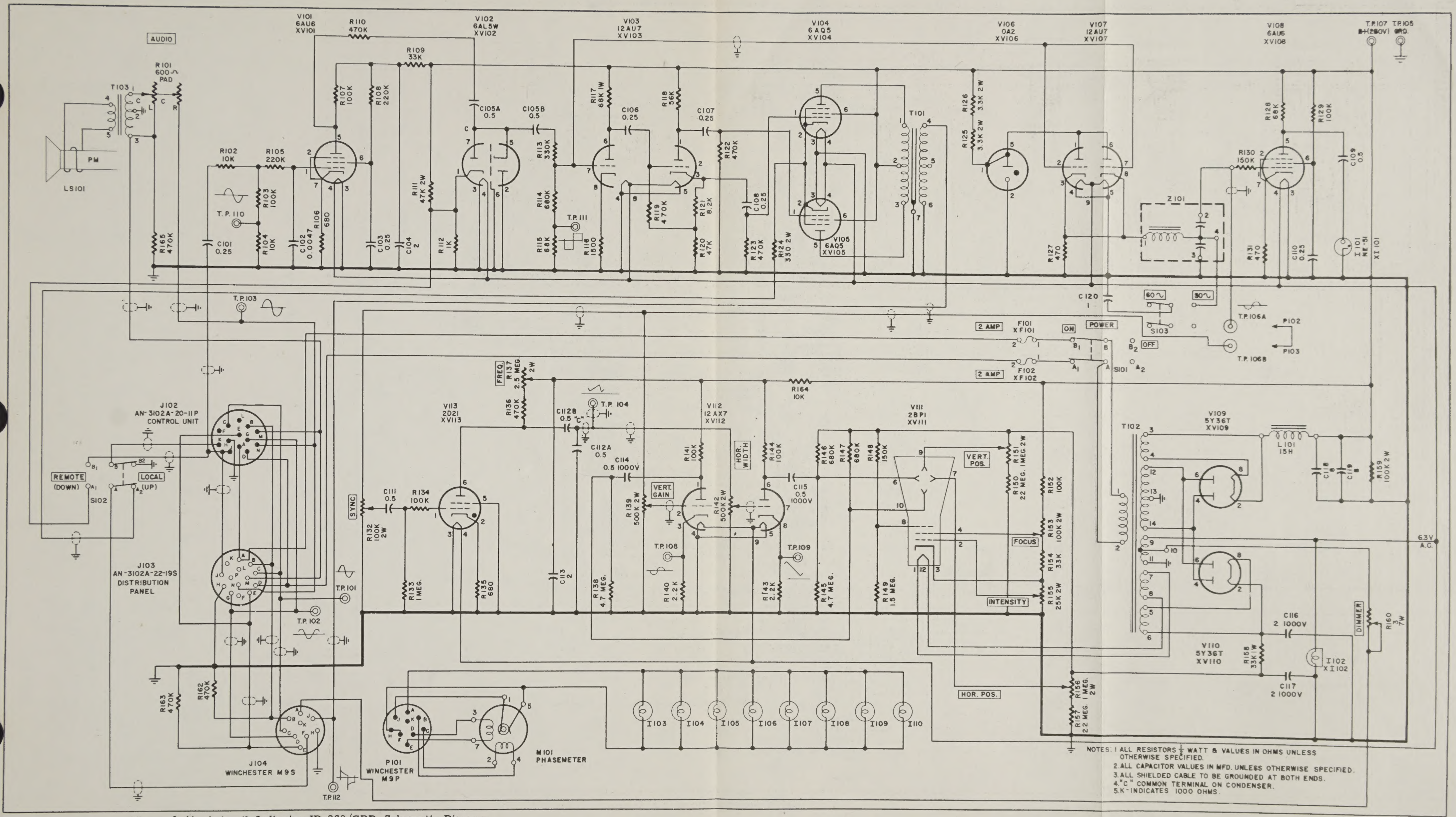
ES: 1 ALL RESISTORS ½ WATT & VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED.
3. ALL SHIELDED CABLE TO BE GROUNDED AT BOTH ENDS.
4. "C" COMMON TERMINAL ON CONDENSER.
5. K-INDICATES 1000 OHMS.

Figure 6-41. Azimuth Indicator ID-



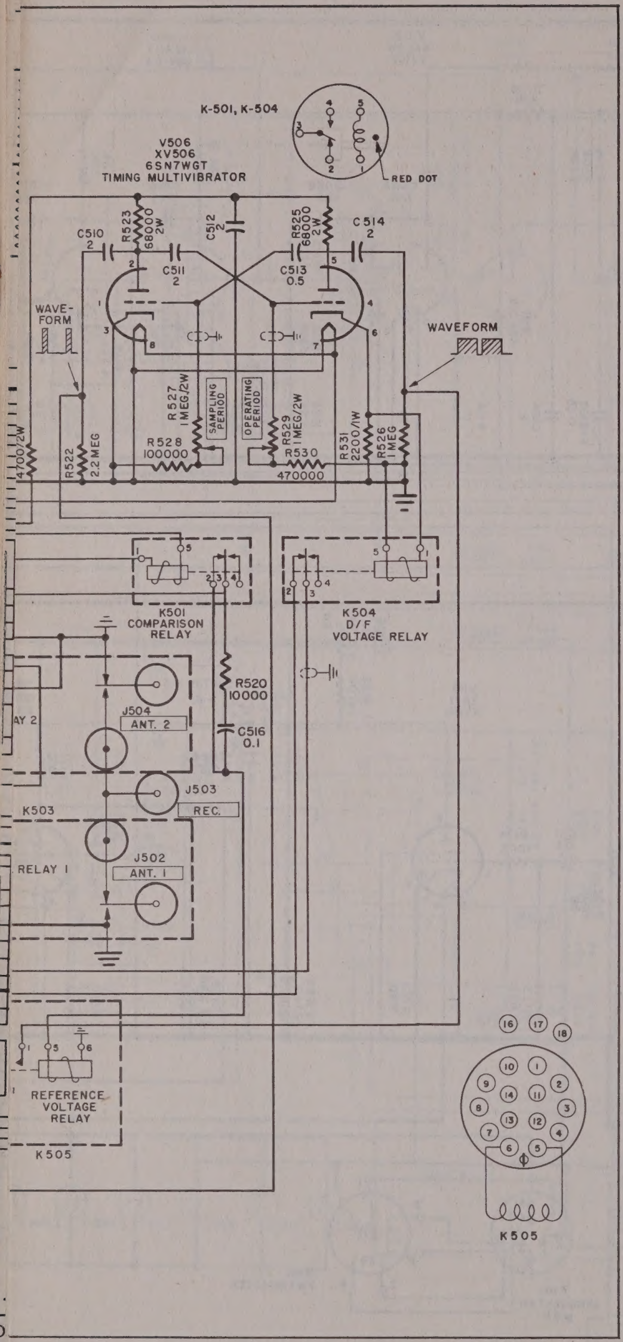
NOTES
1. ALL RESISTORS ½ WATT AND VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS VALUES IN MFD UNLESS OTHERWISE SPECIFIED.
3. K- INDICATES 1000 OHMS.

Figure 6-40. Direction Finder Control C-568/GRD, Schematic Diagram



NOTES: 1. ALL RESISTORS $\frac{1}{2}$ WATT & VALUES IN OHMS UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED.
3. ALL SHIELDED CABLE TO BE GROUNDED AT BOTH ENDS.
4. "C" COMMON TERMINAL ON CONDENSER.
5. K-INDICATES 1000 OHMS.

Figure 6-41. Azimuth Indicator ID-260/GRD, Schematic Diagram



CM-23/GR, Schematic Diagram

Revised 15 February 1954

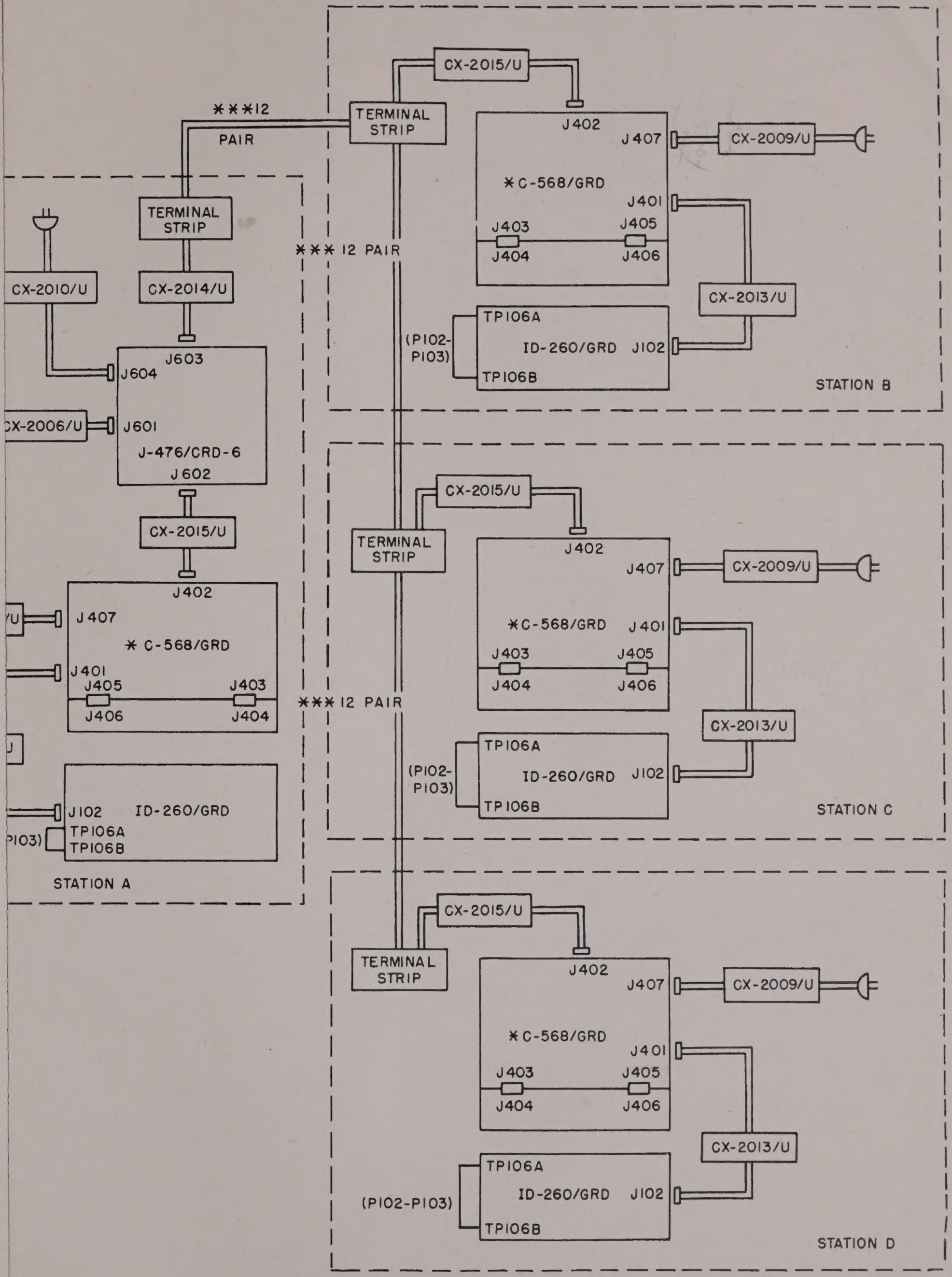
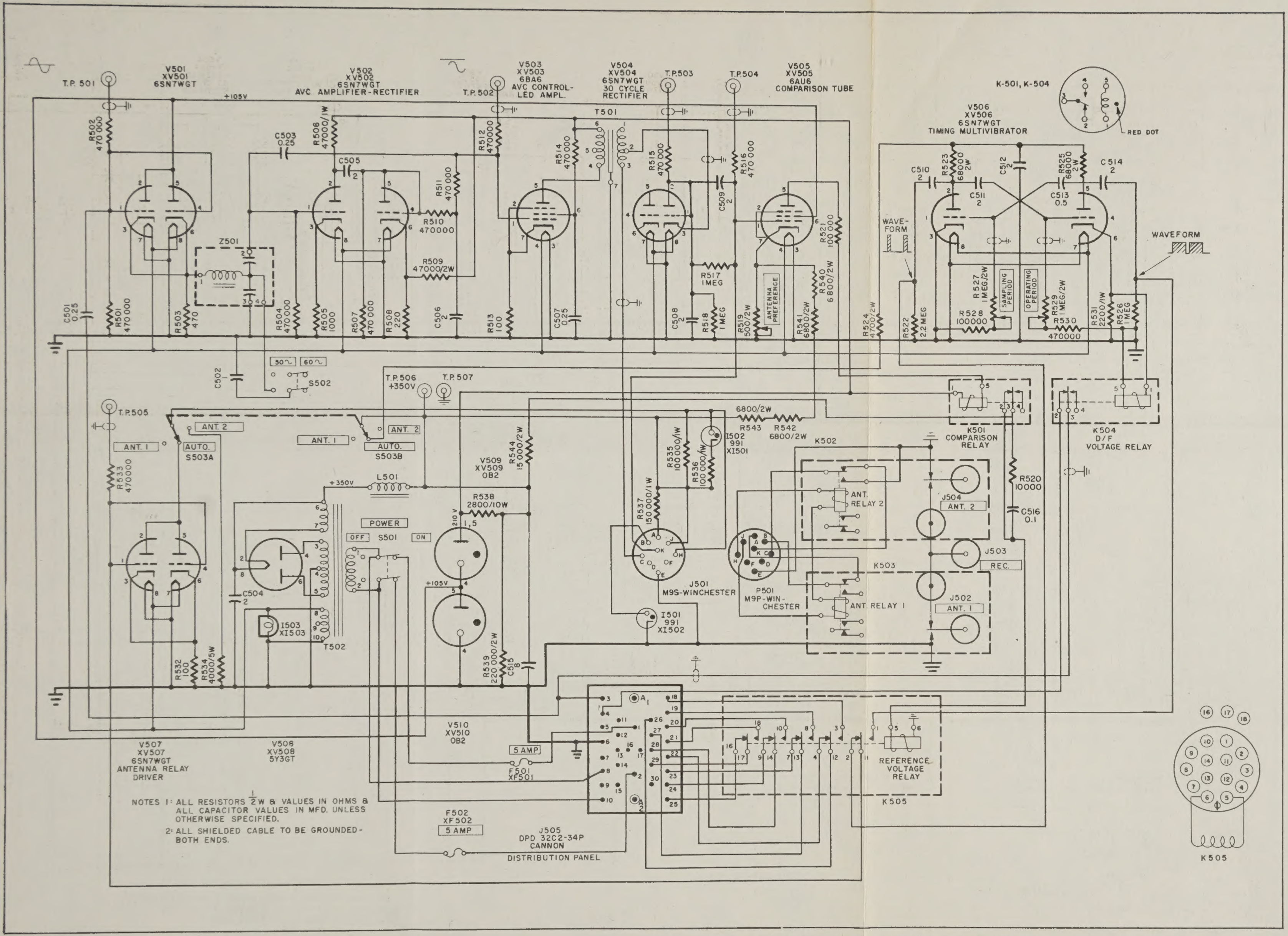


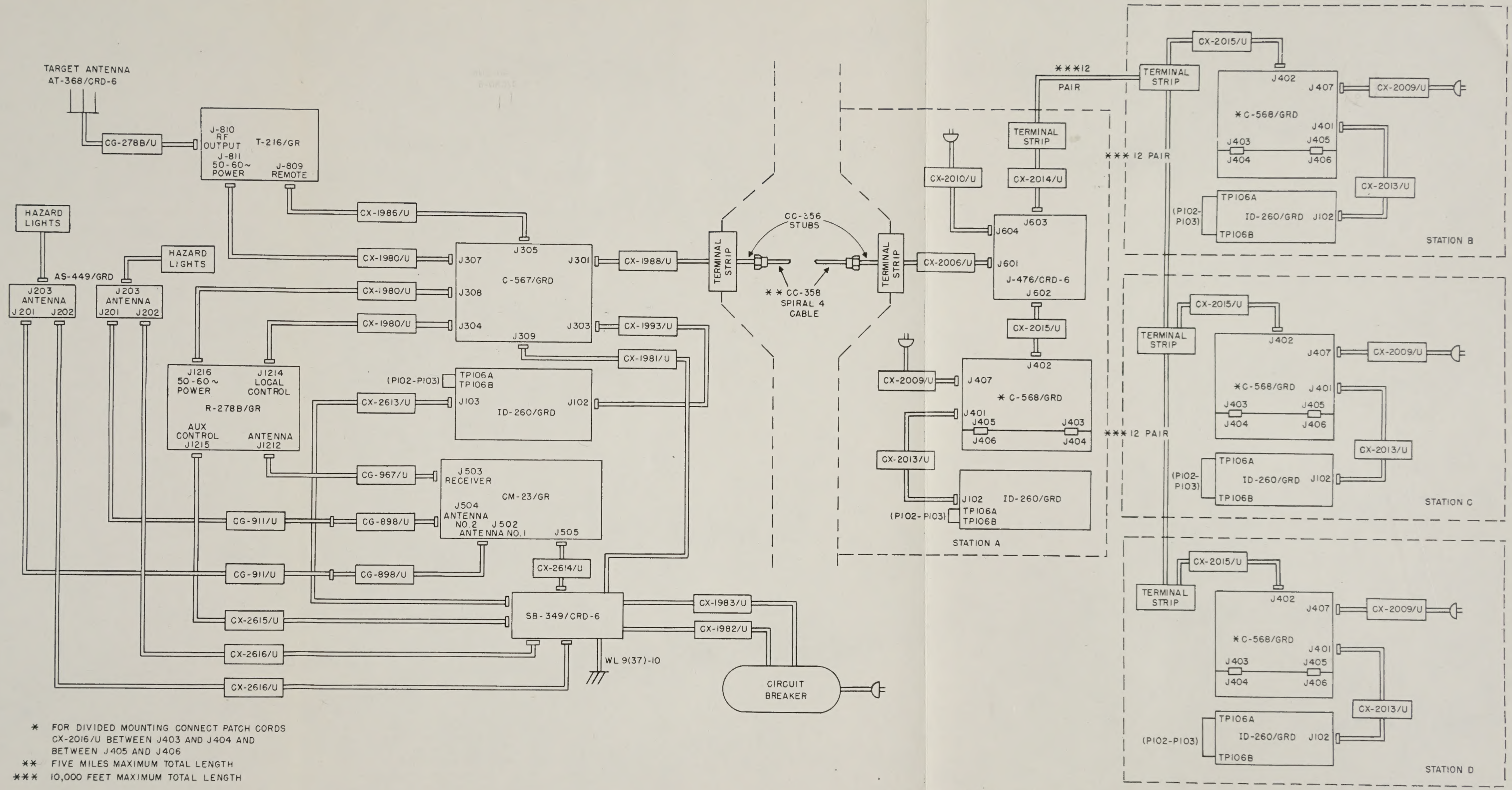
Figure 6-42A. Radio Direction Finder AN/CRD-6, Interconnecting Cable Diagram, as manufactured under Air Force Contract No. AF33(038)-30605



NOTES 1: ALL RESISTORS $\frac{1}{2}$W & VALUES IN OHMS & ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED.

2: ALL SHIELDED CABLE TO BE GROUNDED-BOTH ENDS.

Figure 6-42. Comparator CM-23/GR, Schematic Diagram

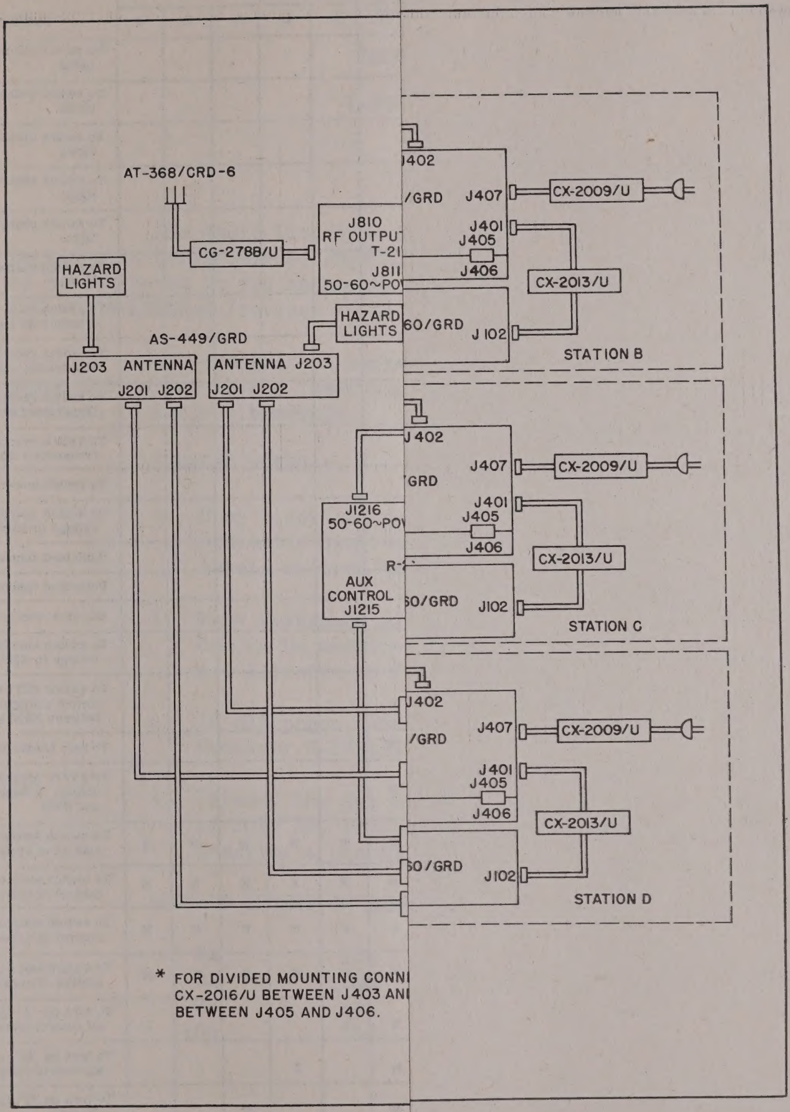


* FOR DIVIDED MOUNTING CONNECT PATCH CORDS CX-2016/U BETWEEN J403 AND J404 AND BETWEEN J405 AND J406

** FIVE MILES MAXIMUM TOTAL LENGTH

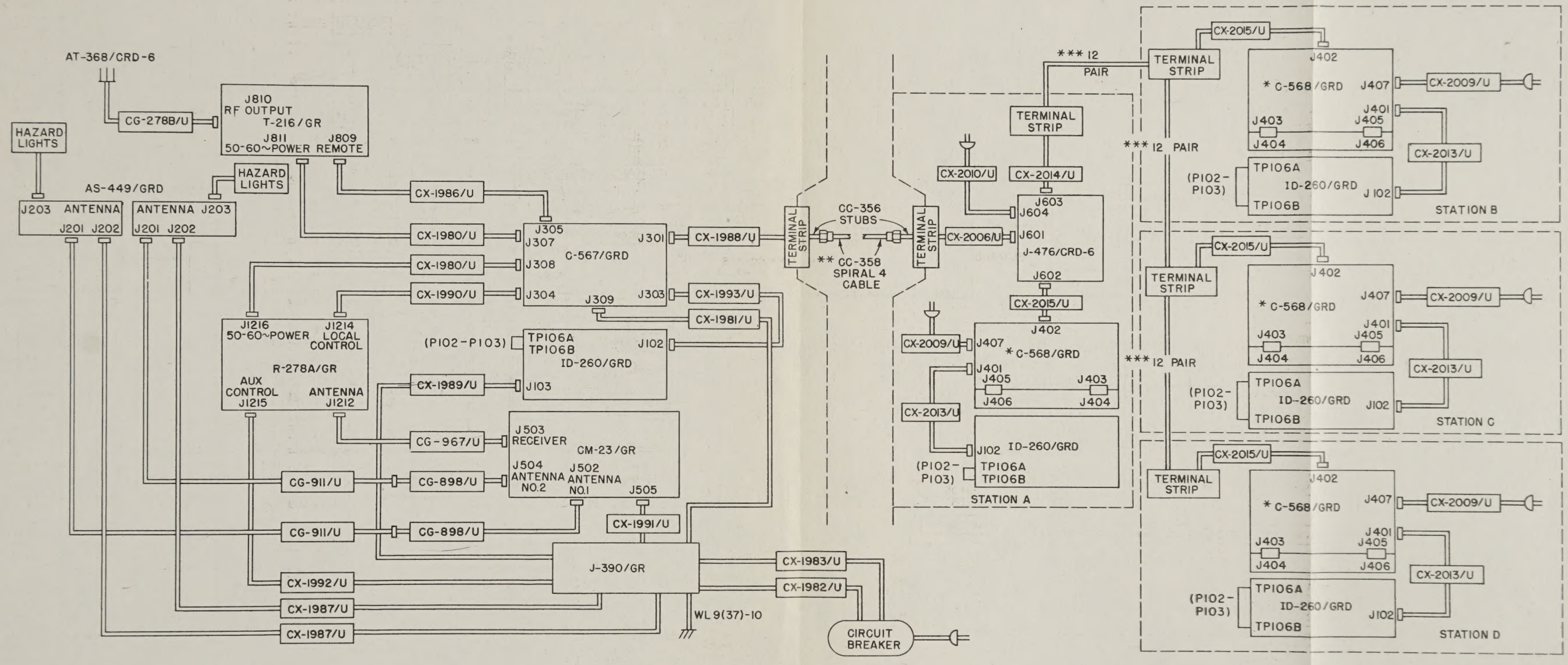
*** 10,000 FEET MAXIMUM TOTAL LENGTH

Figure 6-42A. Radio Direction Finder AN/CRD-6, Interconnecting Cable Diagram, as manufactured under Air Force Contract No. AF33(038)-30605



* FOR DIVIDED MOUNTING CONN
CX-2016/U BETWEEN J403 AN
BETWEEN J405 AND J406.

Figure 6-43. Radio Directi



* FOR DIVIDED MOUNTING CONNECT PATCH CORDS CX-2016/U BETWEEN J403 AND J404 AND BETWEEN J405 AND J406.

** FIVE MILES MAXIMUM TOTAL LENGTH.

*** 10,000 FEET MAXIMUM TOTAL LENGTH.

Figure 6-43. Radio Direction Finder AN/CRD-6, Interconnecting Cabling Diagram

TABLE 6-1

STATE OF ALL RELAYS FOR VARIOUS CONTROL SWITCH POSITIONS

Relay Reference Symbol	POSITION OF SWITCH S-408										Target Switch S-407	Station in Control Selected With Station Switch S-406					FUNCTION
	1	2	3	4	5	6	7	8	9	10	ON	A	B	C	D	A	
K-301	N	N	N	N	N	N	N	N	N	E							To switch channel indicator lights
K-302	N	N	N	N	E	N	N	E	E	N							To switch channel indicator lights
K-303	N	N	N	N	N	E	N	N	E	E							To switch channel indicator lights
K-304	N	N	N	N	N	N	E	N	N	E							To switch channel indicator lights
K-305	N	N	N	N	N	N	N	N	E	N							To switch channel indicator lights
K-306	N	N	N	N	N	N	N	E	N	N							To switch channel indicator lights
K-307	N	E	N	N	E	E	N	E	E	E							To switch receiver and transmitter channels
K-308	N	N	E	N	N	E	E	N	E	E							To switch receiver and transmitter channels
K-309	N	N	N	E	N	N	E	E	N	E							To switch receiver and transmitter channels
K-310	E	N	N	N	E	N	N	E	E	N							To switch receiver and transmitter channels
K-311	E	E	E	E	E	E	E	E	E	E							To switch power on
K-312	N	N	N	E	N	N	E	N	N	N							To switch energizing voltage to K307
K-313	N	–	N	+	N	N	+	N	–	N							Polarized control relay
K-314	N	–	N	+	–	–	+	+	–	+							Polarized control relay
K-315	N	E	N	E	N	N	N	N	N	N							Marginal control relay
K-316	N	E	N	E	N	N	N	N	N	N							To switch energizing voltage to K308
K-317	+	–	–	–	+	–	–	+	+	–	+						To switch K311 and also to switch energizing voltage between K308 and K310
K-318	N	N	N	N	N	N	N	N	N	N	E						To turn transmitter on
K-319	N	E	N	N	E	E	N	N	E	N	N						To switch energizing voltage between K307 and K309
*K401 Station A	N	N	N	N	N	N	N	N	N	N	N	E	N	N	N	E	To switch station A into control of system
*K401 Station B	N	N	N	N	N	N	N	N	N	N	N	N	E	N	N	N	To switch station B into control of system
*K401 Station C	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N	N	To switch station C into control of system
*K401 Station D	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N	To switch station D into control of system
**K601 Position 1	N	N	N	N	N	N	N	N	N	N	N	1				1	To turn on "A" light on all control units
**K601 Position 2	N	N	N	N	N	N	N	N	N	N	N		2				To turn on "B" light on all control units
**K601 Position 3	N	N	N	N	N	N	N	N	N	N	N			3			To turn on "C" light on all units
**K601 Position 4	N	N	N	N	N	N	N	N	N	N	N				4		To turn on "D" light on all units

*K401 is located in Remote Control Unit C-568/GRD
**K601 is located in Junction Box J-476/CRD-6

NOTE: "N" - De-energized "E" - Energized
"+" - Positively energized "–" - Negatively energized

T.O. 31R4-2CRD6-2

ENGINEERING CHANGES

CONTRACT AF61(514)-571

The Radio Direction Finder AN/CRD-6, as manufactured by Le Materiel Telephonique, FRANCE, includes engineering changes which are to be reflected in the maintenance instructions contained in Handbook T.O. 31R4-2CRD6-2 (revised 10 December 1954).

The changes and corrections are indicated in the general notes which follow and in the insertion sheets listed below which will be inserted as shown in subject handbook.

GENERAL NOTES :

a. Many minor changes and corrections had to be made to the schematic diagrams. For correct reference use the circuit labels secured inside the units.

b. Many reference symbol numbers and identification part numbers had to be modified, added or deleted. For correct reference use Illustrated Parts Catalog T.O. 31R4-2CRD6(PE)-4.

c. In all pages concerned, substitute Receiver R-278B/GR to Receiver R-278A/GR or Receiver R-278/GR.

d. Discard the two Supplements 31R4-2CRD6-2A and 31R4-2CRD6-2B of July 15, 1955 and September 20, 1956 respectively, which describe a procedure for adjustment of the Comparator CM-23/GR.

LIST OF INSERTION SHEETS.

5A
9A
9B
10A
12A
13A
14A
15A
16A
20A
22A
23A
37A
74A
75A
76A
78A
79A
84A
85A
86A

Page 5 - Paragraph2-24.

Delete :

"Thermostat S201 adds capacitor C203 to the motor when the temperature is below freezing".

Substitute :

"In case of use of U.S. made motor (B201), thermostat S201 adds capacitor C203 to the motor when the temperature is below freezing. In case of use of motors manufactured by Tollim (France), capacitor C203 is not connected to thermostat S201, and is not used, as no additional capacitor is needed for starting at low temperature".

Page 9, figure 2 - 7.

Output of T501 across winding 1-3 instead of 2-3 and shunted by a 47000 ohm resistor, R545 (See figure 2-8 A.)

Page 9, paragraph 2 - 43.

To be supplemented by the following paragraphs :

2-43A - Normally, when antenna No. 2 provides the stronger signal, the operation of the comparator is as described in paragraph 2-42, but when antenna No. 2 presents a large signal during the sampling time and antenna No. 1 has been supplying a small signal, incorrect antenna selection may occur.

This happens as follows :

a. Since there is little or no avc voltage due to the antenna No. 1 signal, the gain of V503 is high.

b. At the start of the sampling period antenna No. 2 is connected and the signal if greatly amplified causing storage circuit No. 2 to provide a large negative pulse to V505.

c. The plate current of V505 is greatly reduced and K501 drops out.

d. This very rapidly energizes K505 causing the multivibrator output of long period pulses from pin 5 of V506B, figure 2-9, to be supplied to the antenna relay driver. But, since it is in the low voltage state, relays K502 and K503 are de-energized; storage circuit No. 1 and antenna No. 1 are connected.

e. The high Q of Z501 causes the relatively high voltage which was applied by antenna No. 2 to the comparator to remain for a few tenths of a second after antenna No. 2 is removed from the input circuit. Therefore, the No. 1 storage circuit does not see the low signal presented by antenna No. 1, but instead the high ringing voltage due to Z501.

f. This produces a high positive voltage to be applied to V505 and in turn K505 becomes de-energized.

g. The antenna relay driver is now switched to the short duration pulses, pin 2 of V506A, figure 2-9, which are in their low state by this time. Thus relays K502 and K503 remain de-energized and the incorrect antenna remains connected.

h. If the positive pulse due to ringing of Z501 were not present then K505 would remain energized and relays K502 and K503 would automatically reconnect to antenna No. 2, because the multivibrator output, pin 5 of V506B, figure 2-9, would be on the high level part of its period.

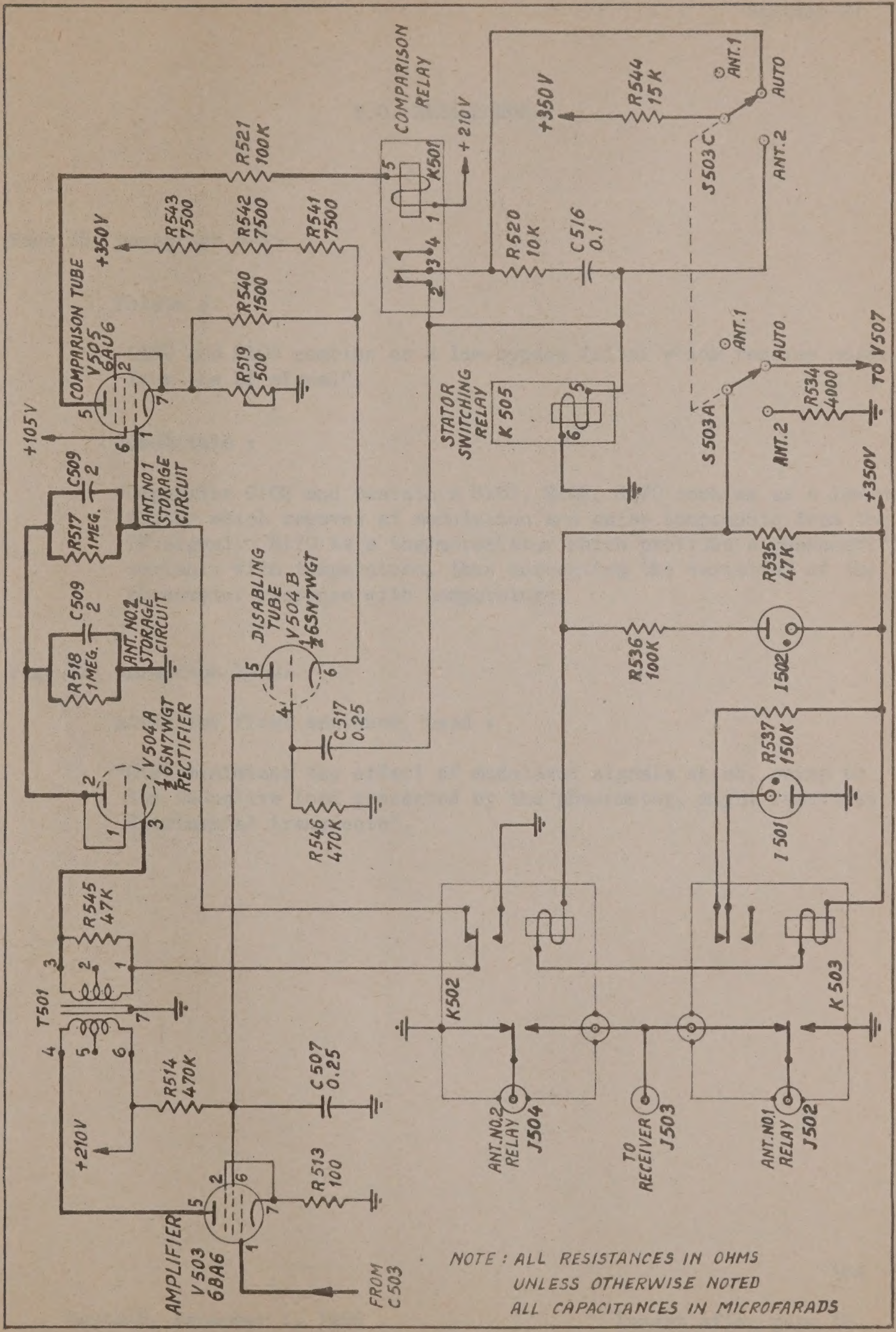
2-43B. All sets manufactured on Contract AF61(514)-571 have been modified to prevent the above described faulty action. (See figure 2-8A). This is accomplished in the following manner :

a. Whenever relay K505 is actuated, i.e. when antenna No. 2 becomes the preferred antenna, a positive pulse (due to +350V being connected to K505) is applied to the control grid of the disabling tube, V504B, through C517.

b. V504B conducts causing the screen voltage of V503 to drop, thus lowering the gain of V503. This reduces to a large extent the undesired ringing voltage due to Z501 from being applied to the secondary of T501.

c. The voltage divider R543, R542, R541 and R519, common to V504B and V505, causes a reduction in gain of V505 when V504B conducts thus further reducing the effect of the undesired ringing voltage.

d. The positive pulse, mentioned in a. above, is so short that it does not disturb the further operation of the comparator, but is long enough to eliminate the erroneous charging of storage circuit No. 1.



NOTE: ALL RESISTANCES IN OHMS UNLESS OTHERWISE NOTED
ALL CAPACITANCES IN MICROFARADS

Figure 2-8. Comparator CM-23/GR Storage and Comparison Circuits, Simplified Schematic Diagram

Page 12, paragraph 2-54.

Delete :

"C102 and R105 combine as a low-bypass filter which removes noise from the DF signal".

Substitute :

"Capacitor C102 and resistors R105, R168, R170 combine as a low-pass filter which removes af modulation and noise components from the DF signal. R170 is a thermoresistor which provides a phase-shift variable with temperature, thus correcting the variation of the phasemeter response with temperature.

Page 12, paragraph 2-58.

After the first sentence, read :

"C121 minimizes the effect of modulated signals which, owing to the inductive load presented by the phasemeter, might result in detrimental transients".

Page 13, figure 2-12 :

Change value of resistor R105 to 390,000 ohms

Introduce resistor R168 (100,000 ohms) and thermoresistor R170 (100,000 ohms) in parallel between R105 and junction joint of R102 and R103.

Change value of capacitor C102 to 0.01 microfarad.

Page 13, Figure 2-13

Introduce capacitor C121 (0.0012 microfarad) between grid of tube V103A and ground.

Page 14, figure 2-14

Introduce resistor R166 (220,000 ohms) between terminal 2 of Z101 and ground.

Page 15, figure 2-15

Delete connection to ground of terminal 5 of V113

Introduce resistor R167 (4,700 ohms) connected across terminals 2 and 5 of tube V113.

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Page 16, figure 2-16.

Change value of resistor R160 to 10 Ohms

Page 20, figure 2-21.

Contacts of K313 : 1 and 4 should be reversed.

Connections of K304 : C1 and C2 should be reversed.

Connections of K308 : C1 and C2 should be reversed.

Page 22, paragraph 2-91

Delete

"and C402"

"and C407"

Page 23, figure 2-25

- Delete capacitors C402 and C407
- Change value of capacitors C401 and C406 to 0.1 microfarad
- Change value of resistors R401 and R416 to 53,000 ohms and of resistors R402 and 416 to 10,600 ohms.

Page 37, figure 4-9

The top of the antenna is modified; for correct reference use figure 13 in Illustrated Parts Catalog T.O. 31R4-2CRD6 (PE)-4

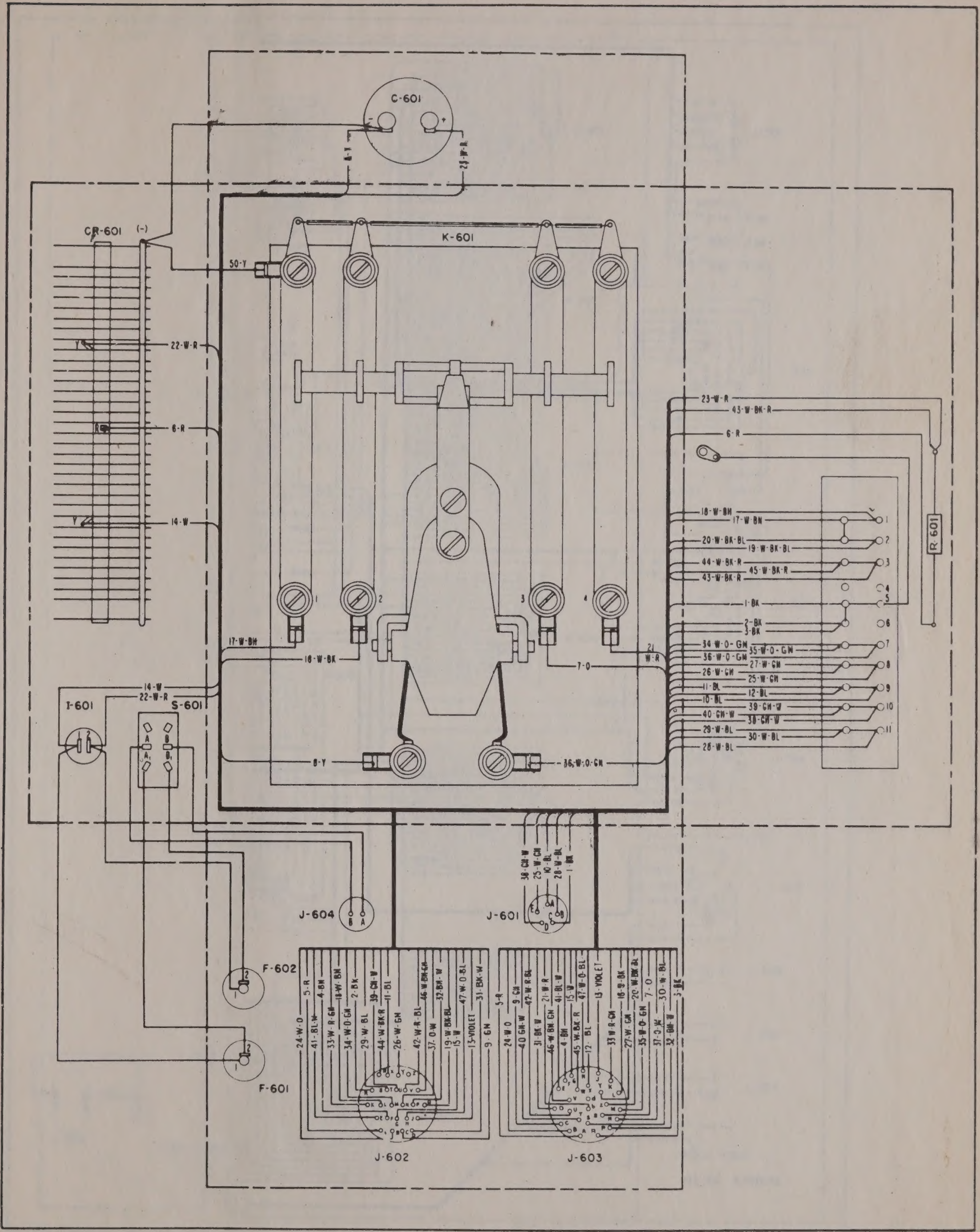
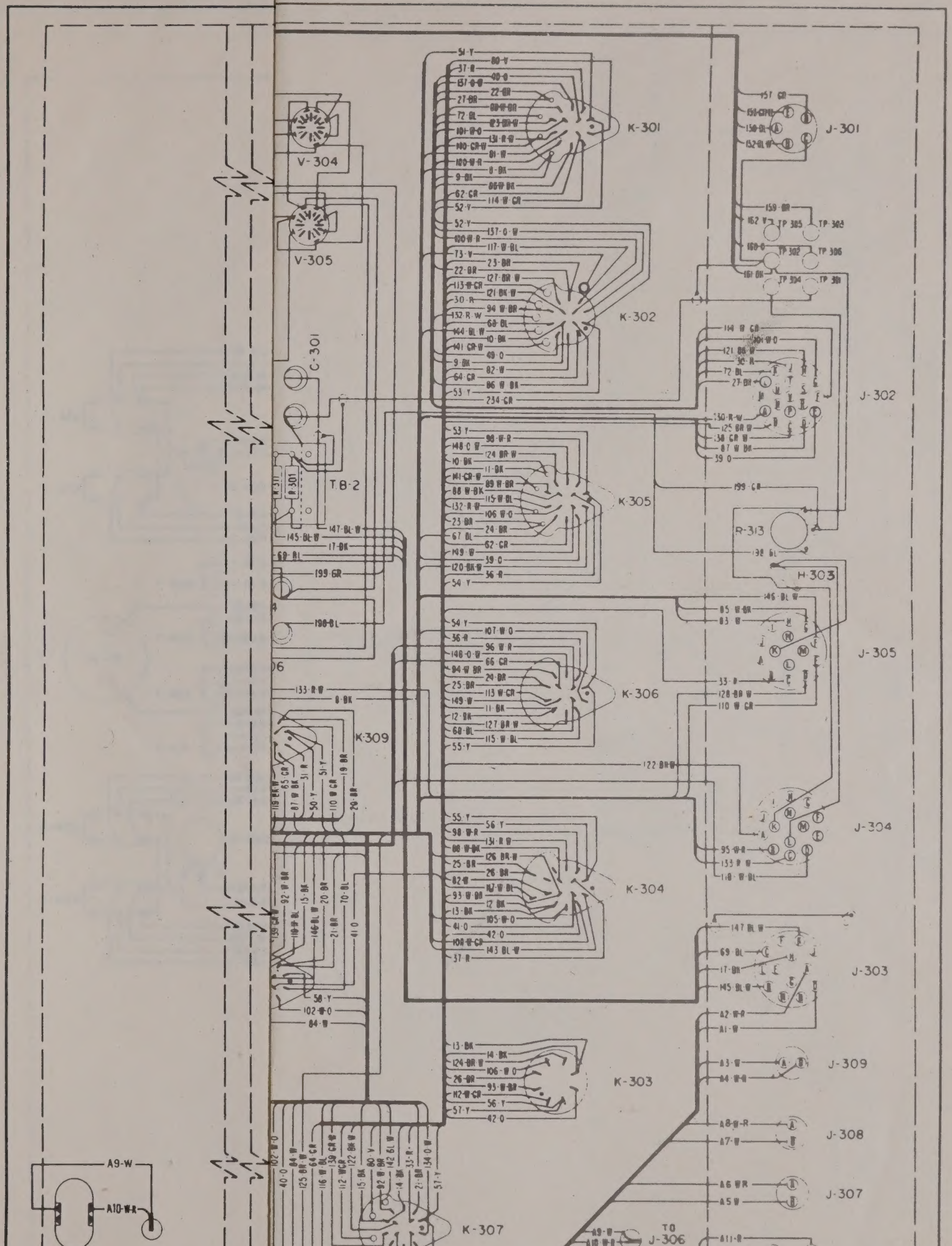


Figure 6-30 A Junction Box J-476*I*CRD-6, Practical Wiring Diagram



Direction Finder Control C-567/GRD, Practical Wiring Diagram

Revised December 1, 1956

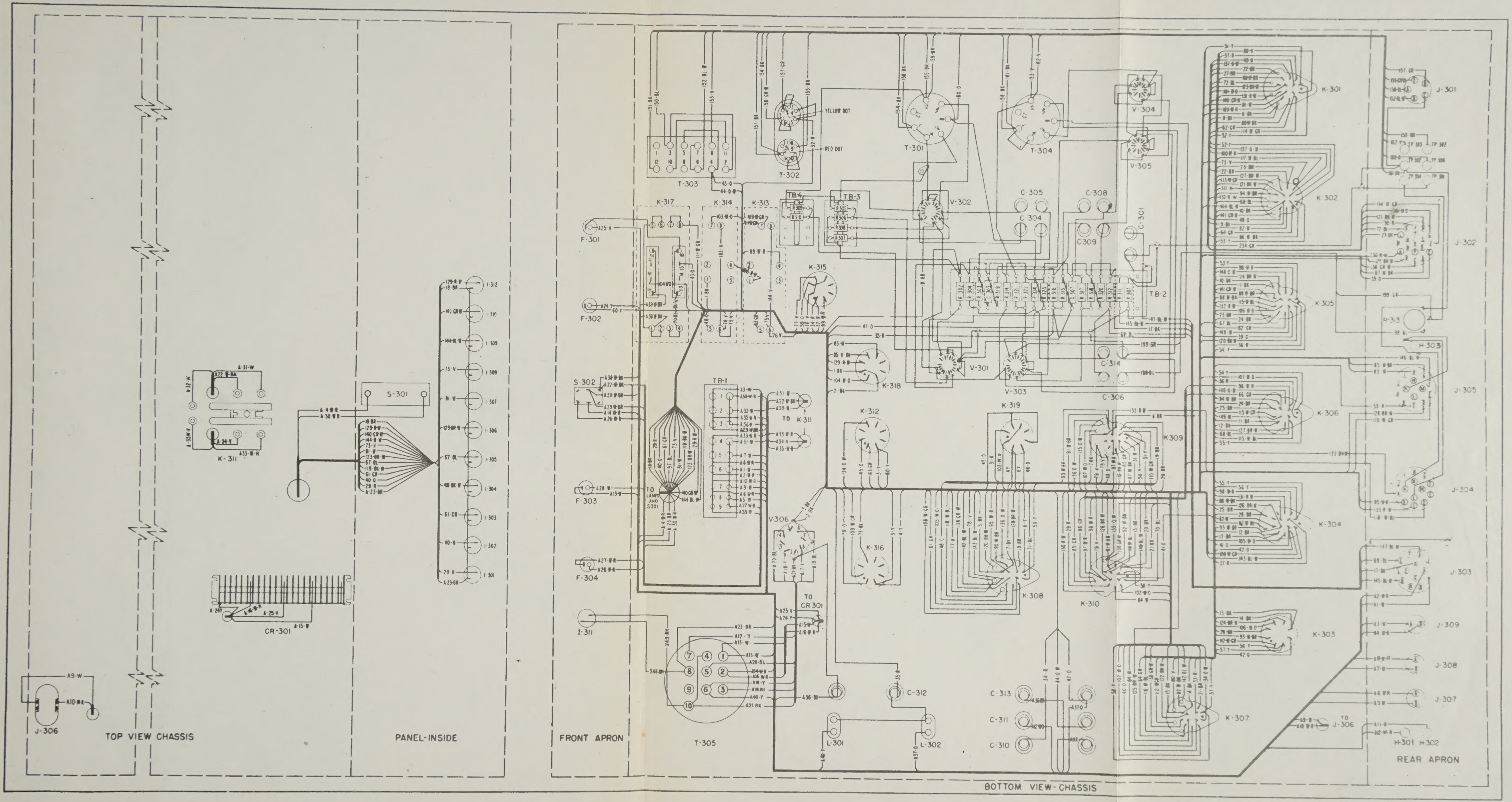
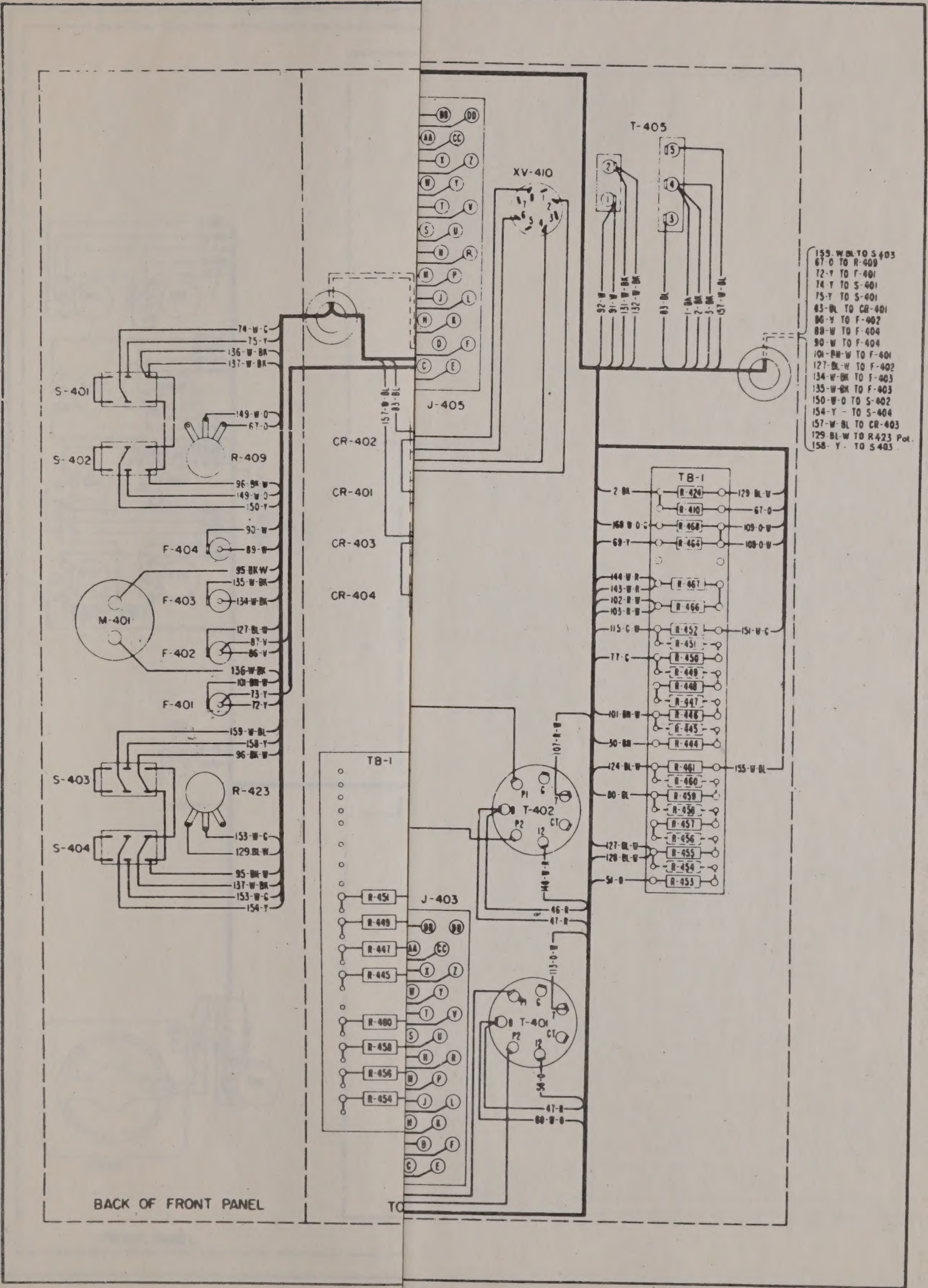


Figure 6-31 A Direction Finder Control C-567/GRD, Practical Wiring Diagram



r Control C-568/GRD. Practical Wiring Diagram

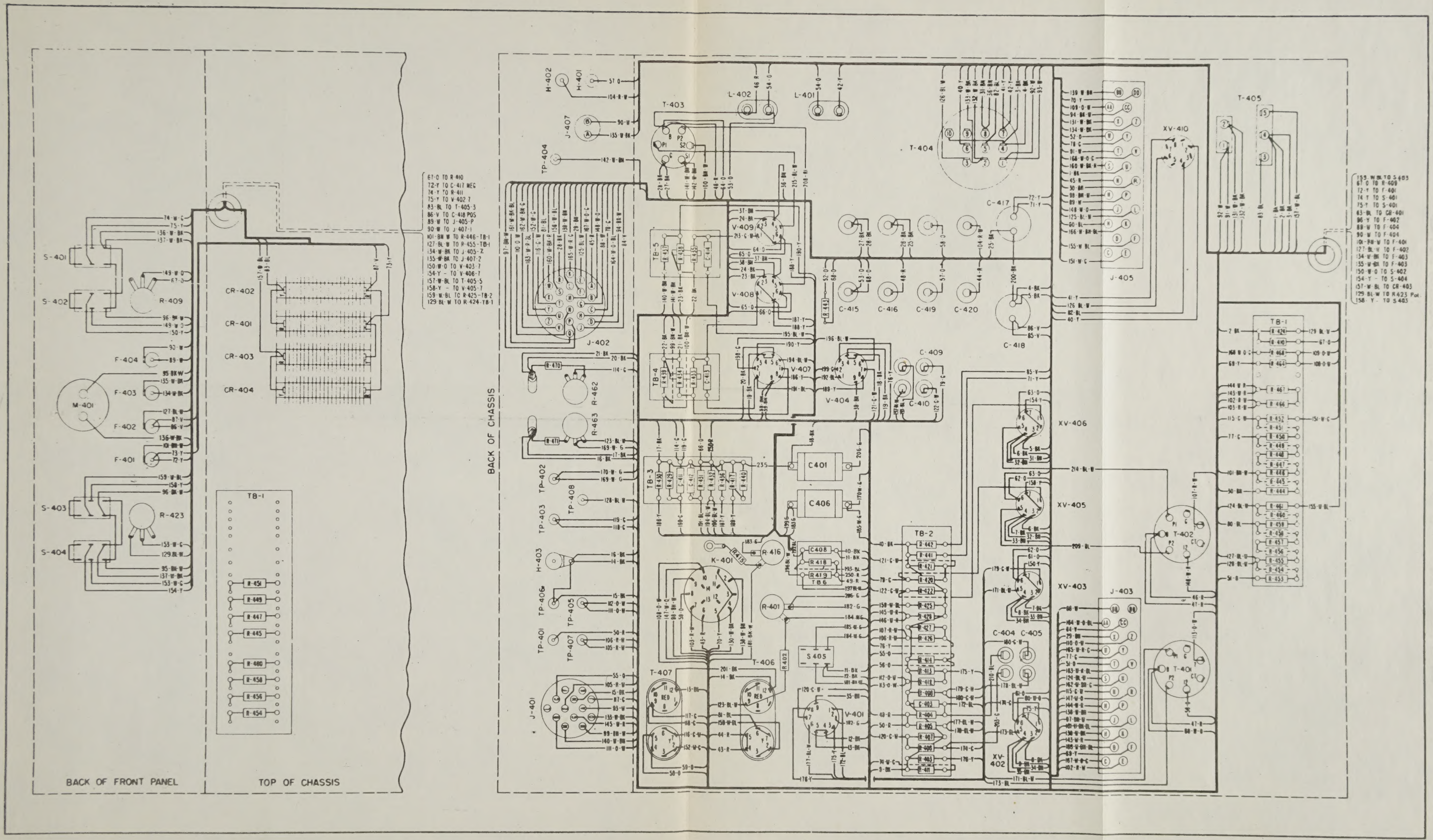
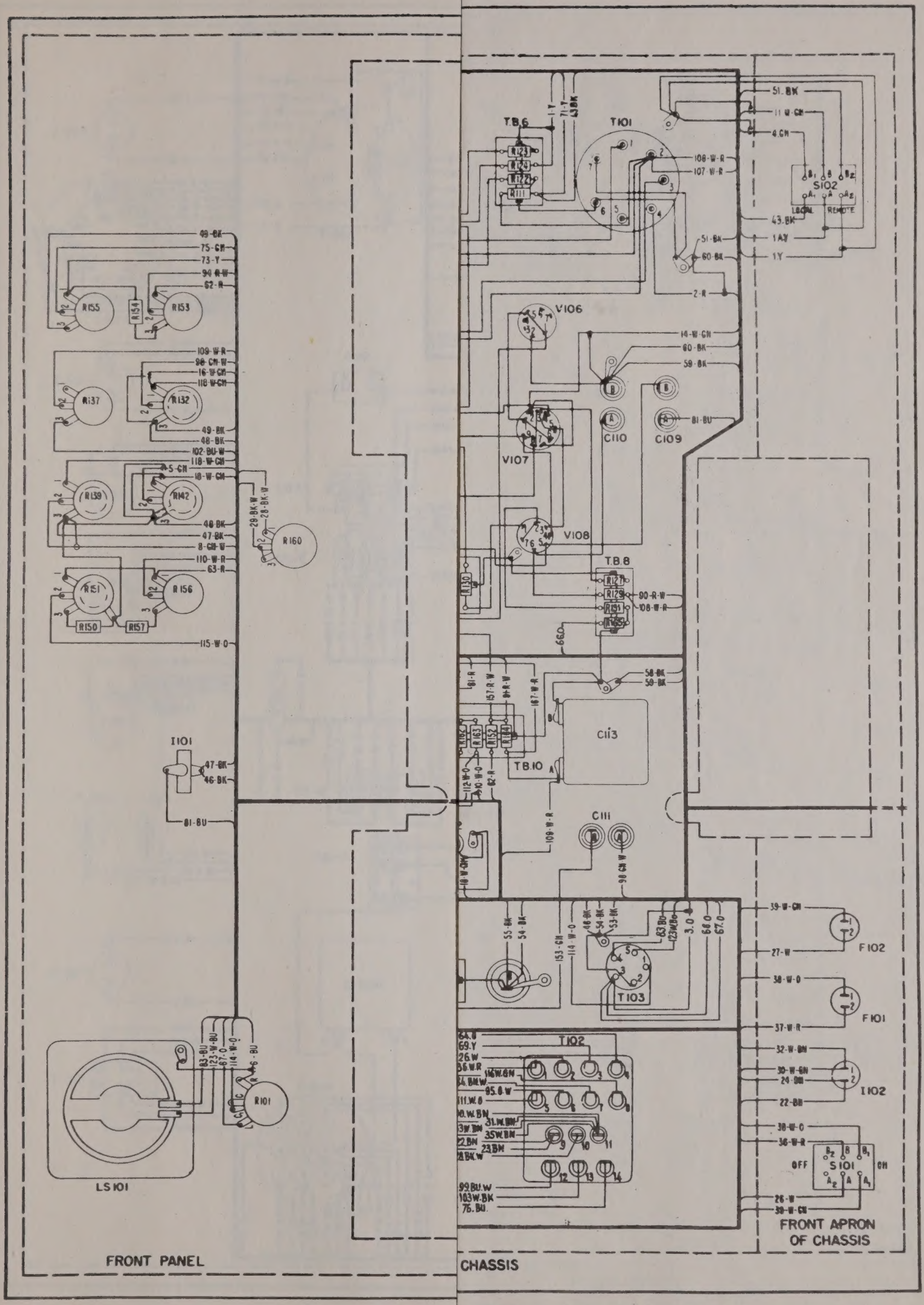


Figure 6-32 A Direction Finder Control C-568/GRD Practical Wiring Diagram



or ID-260/GRD, Practical Wiring Diagram

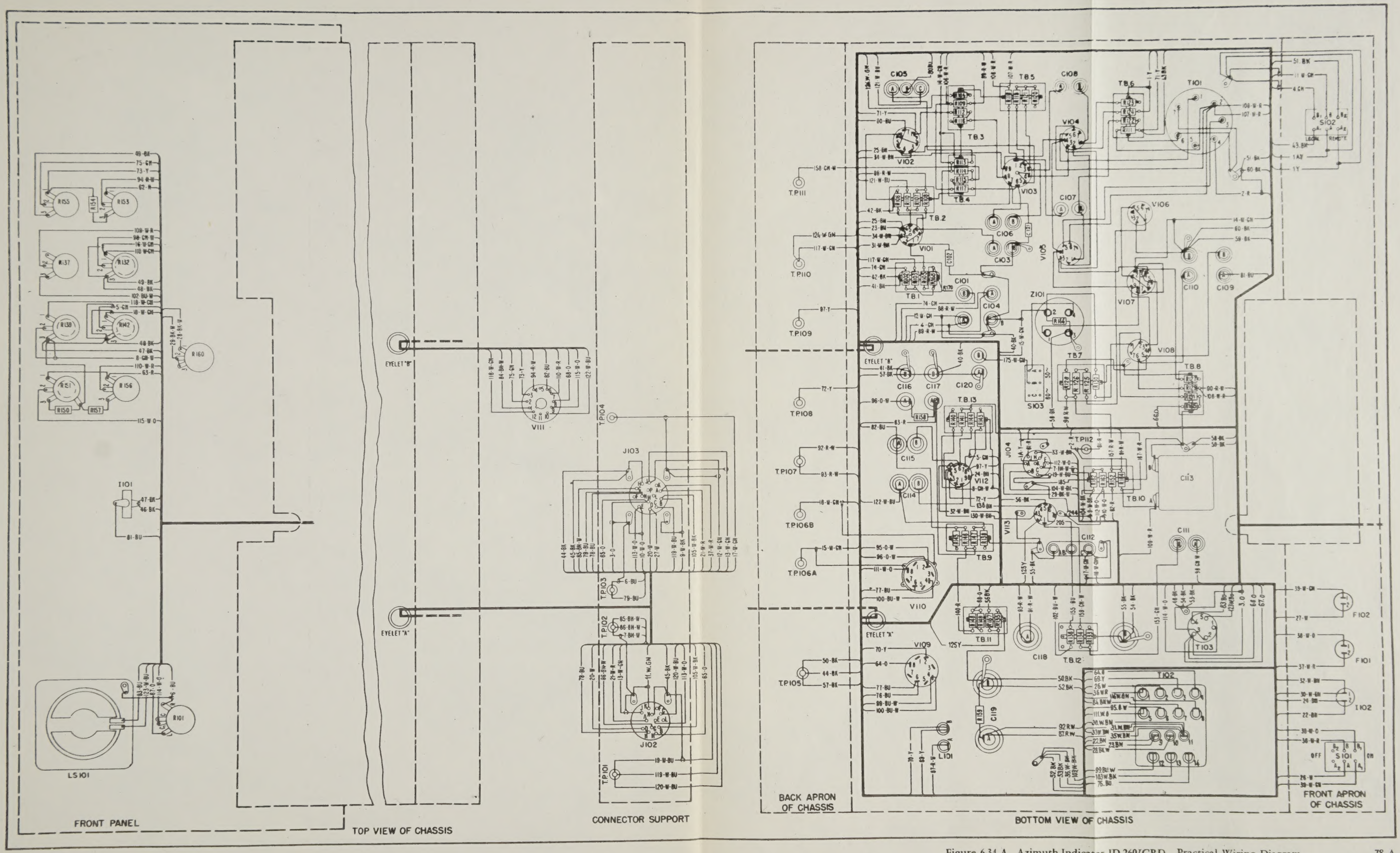
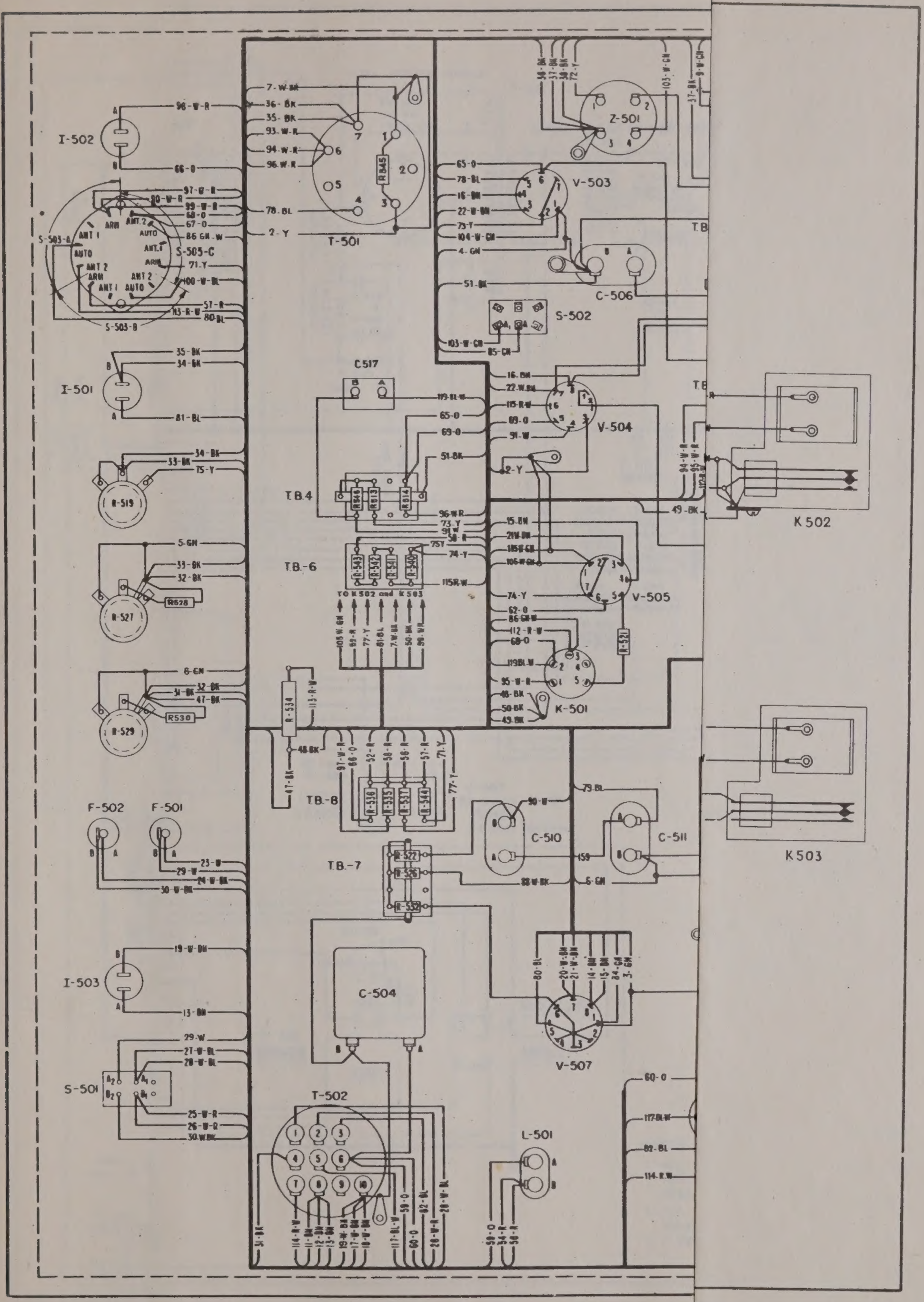


Figure 6-34 A Azimuth Indicator ID-260/GRD, Practical Wiring Diagram


I-502
T-501
R545
Z-501
V-503
S-503-A
S-505-C
S-503-B
C-506
S-502
T.B
C517
I-501
V-504
K 502
T.B.4
R-519
T.B.-6
TO K502 and K503
V-505
R-527
R528
R-521
K-501
R-529
R530
R-534
T.B.-8
F-502
F-501
C-510
C-511
K503
T.B.-7
I-503
C-504
V-507
S-501
T-502
L-501

gram

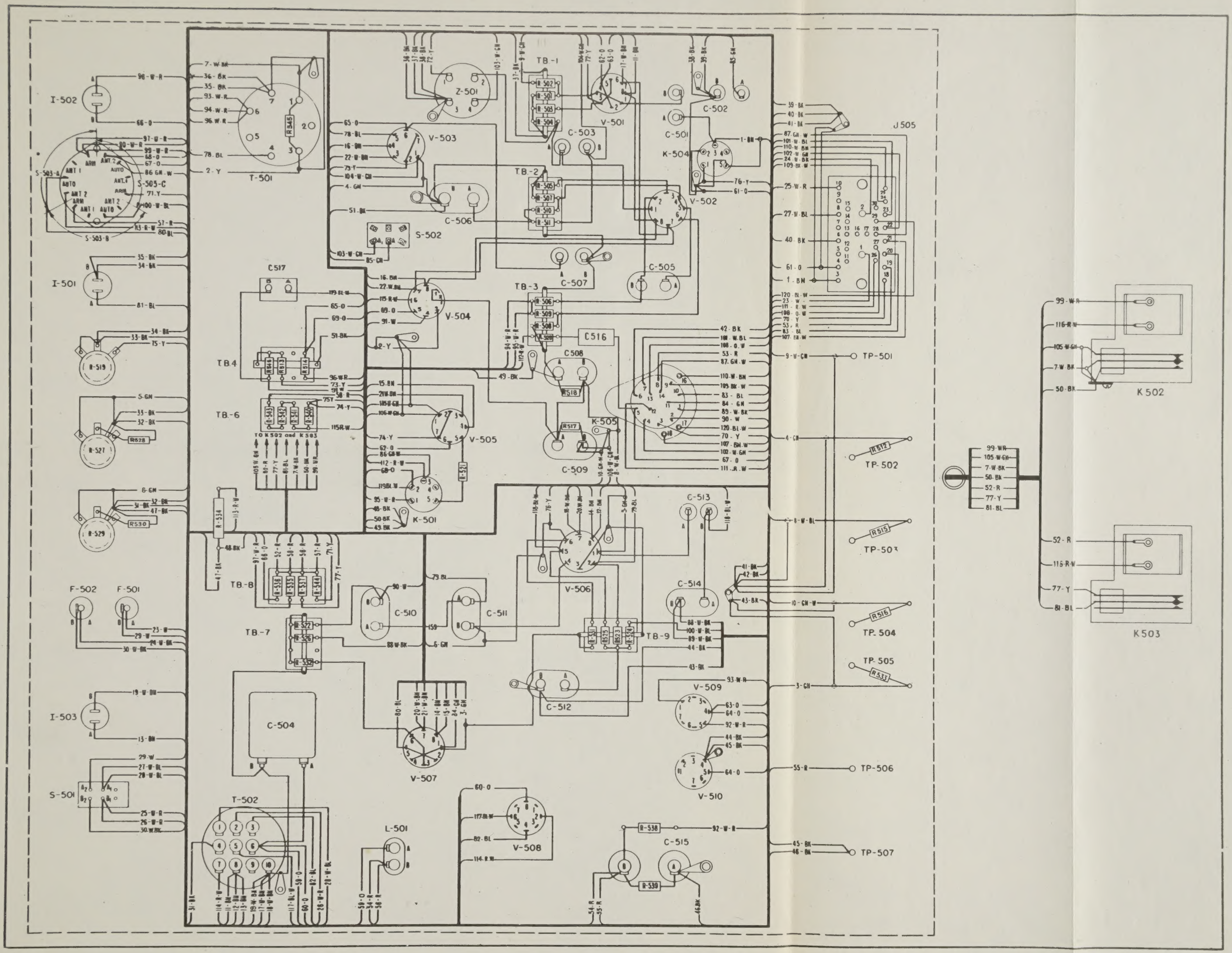
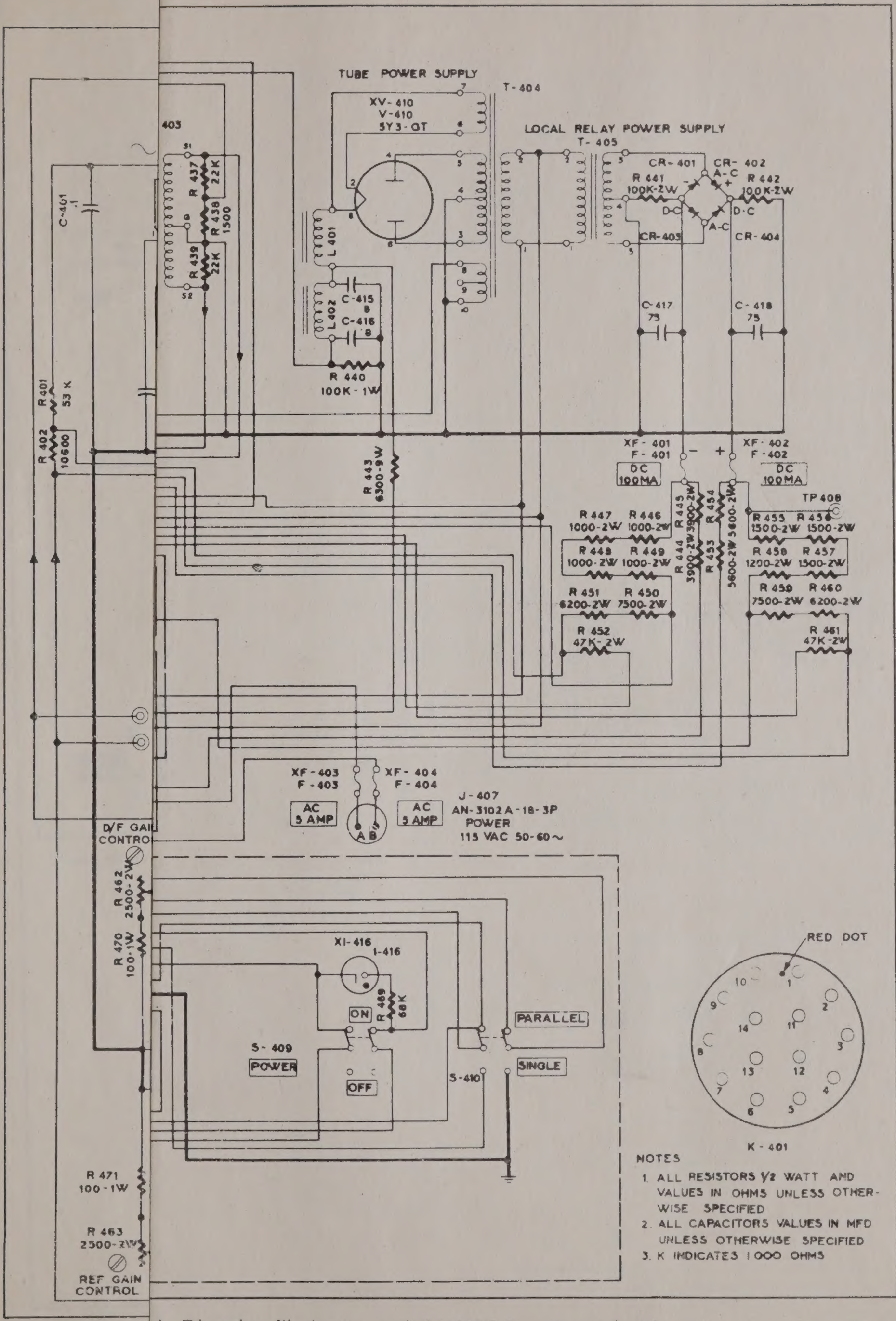


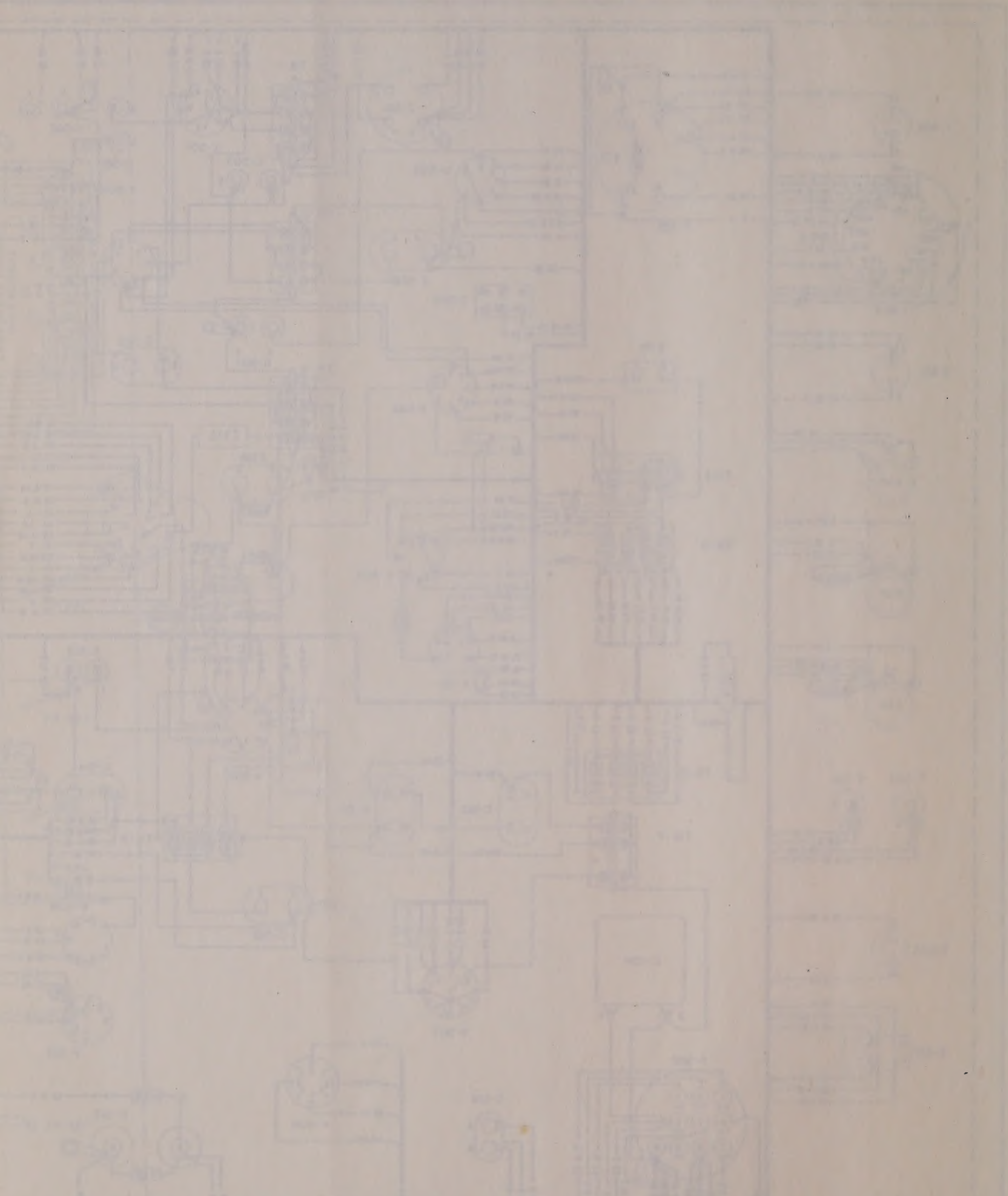
Figure 6-35 A Comparator CM-23/GR, Practical Wiring Diagram

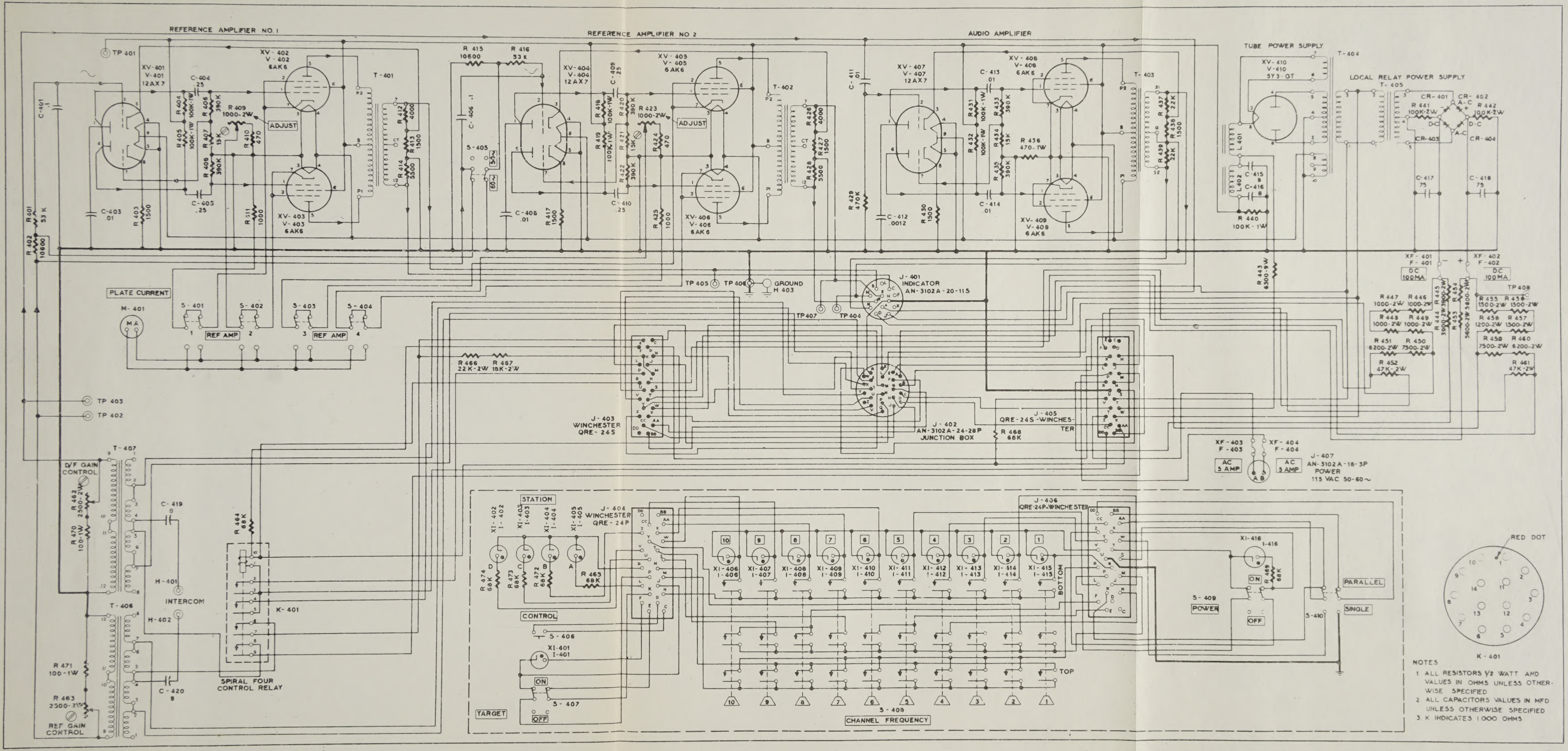


NOTES

1. ALL RESISTORS 1/2 WATT AND VALUES IN OHMS UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS VALUES IN MFD UNLESS OTHERWISE SPECIFIED
3. K INDICATES 1 000 OHMS

A Direction Finder Control C-568/GRD, Schematic Diagram

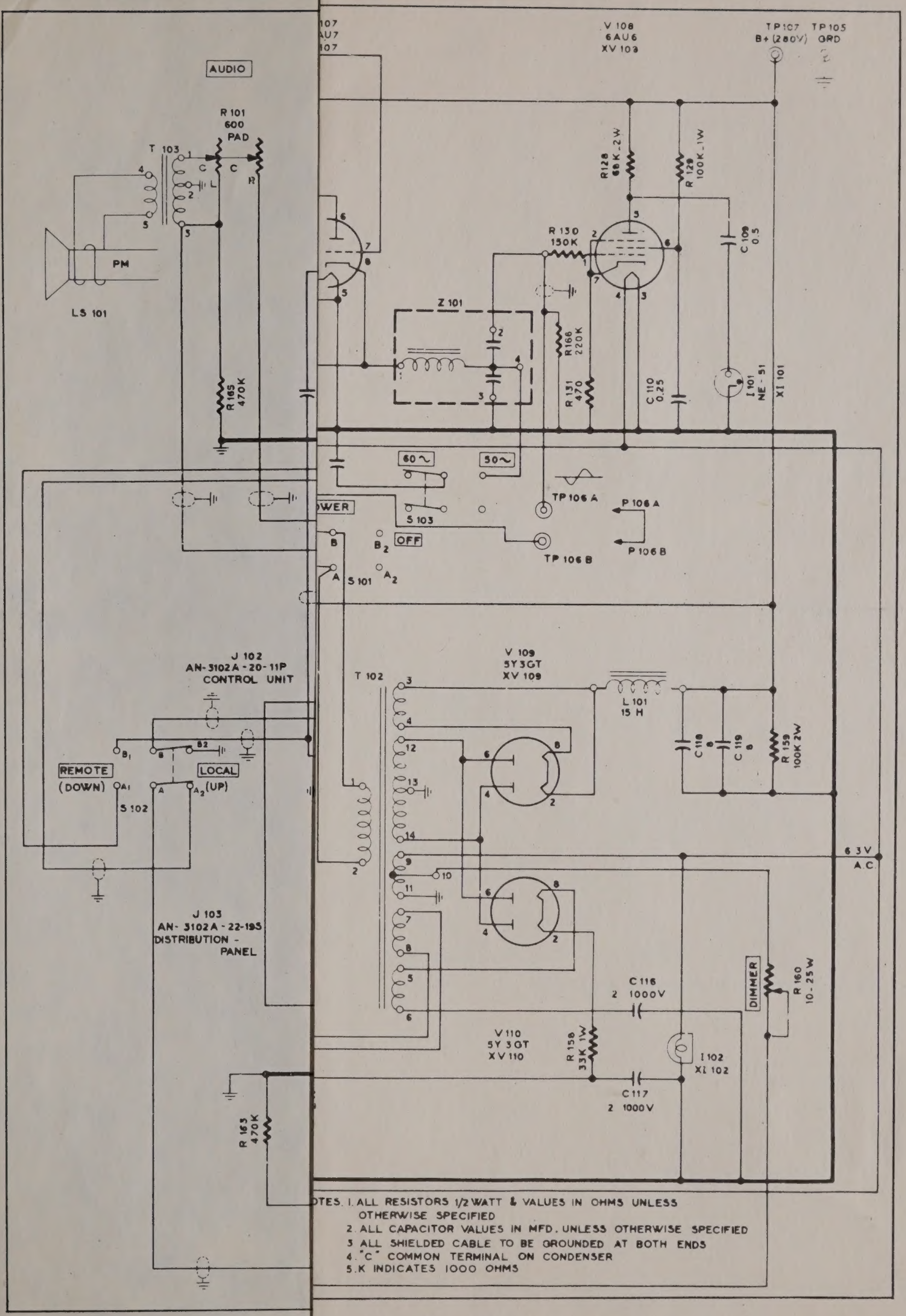




NOTES

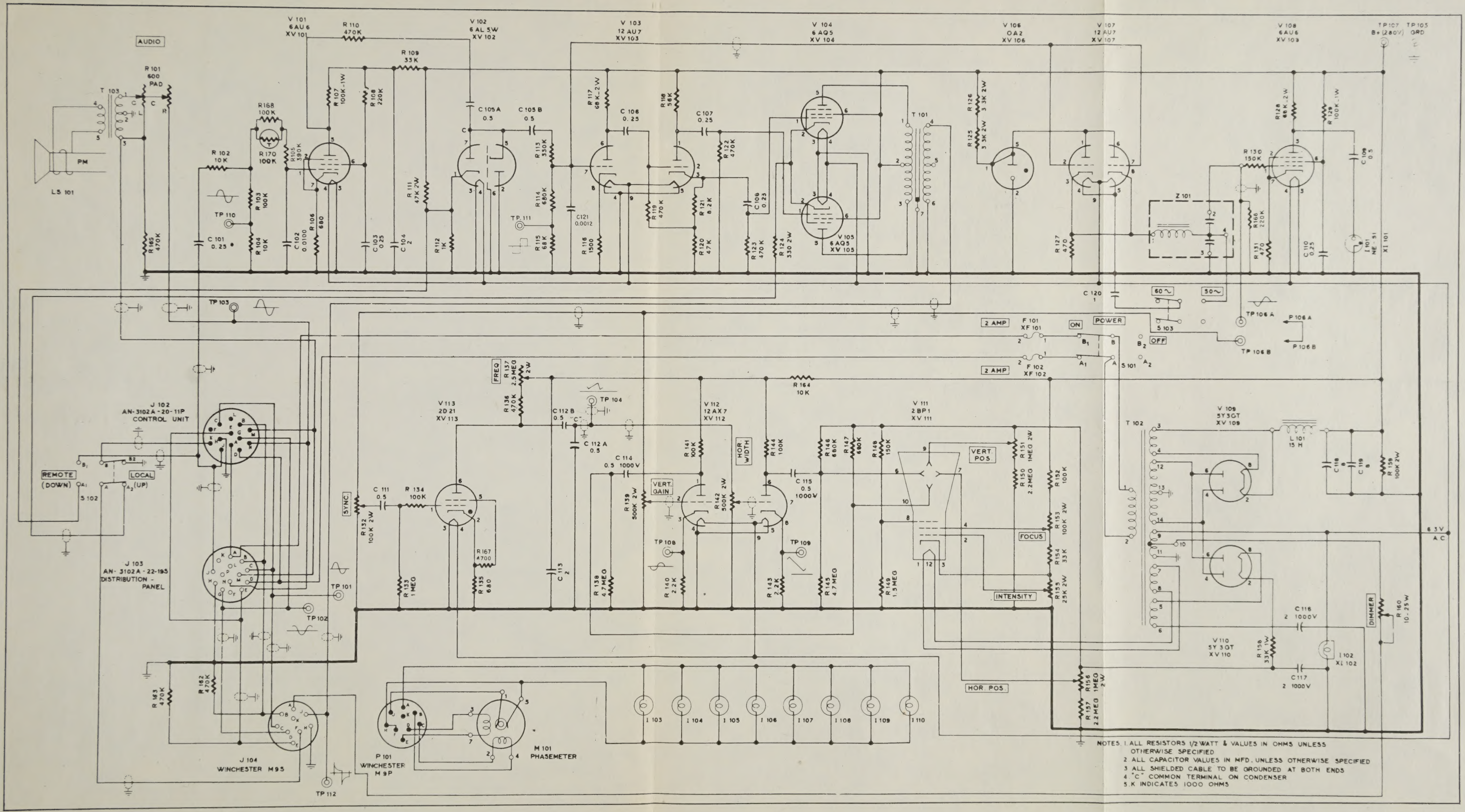
1. ALL RESISTORS 1/2 WATT AND VALUES IN OHMS UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS VALUES IN MFD UNLESS OTHERWISE SPECIFIED
3. K INDICATES 1 000 OHMS

Figure 6-40 A Direction Finder Control C-568/GRD, Schematic Diagram



TES. 1. ALL RESISTORS 1/2 WATT & VALUES IN OHMS UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED
3. ALL SHIELDED CABLE TO BE GROUNDED AT BOTH ENDS
4. "C" COMMON TERMINAL ON CONDENSER
5. K INDICATES 1000 OHMS

th Indicator ID-260/GRD, Schematic Diagram



NOTES. 1. ALL RESISTORS 1/2 WATT & VALUES IN OHMS UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITOR VALUES IN MFD. UNLESS OTHERWISE SPECIFIED
3. ALL SHIELDED CABLE TO BE GROUNDED AT BOTH ENDS
4. "C" COMMON TERMINAL ON CONDENSER
5. K INDICATES 1000 OHMS

Figure 6-41 A Azimuth Indicator ID-260/GRD. Schematic Diagram